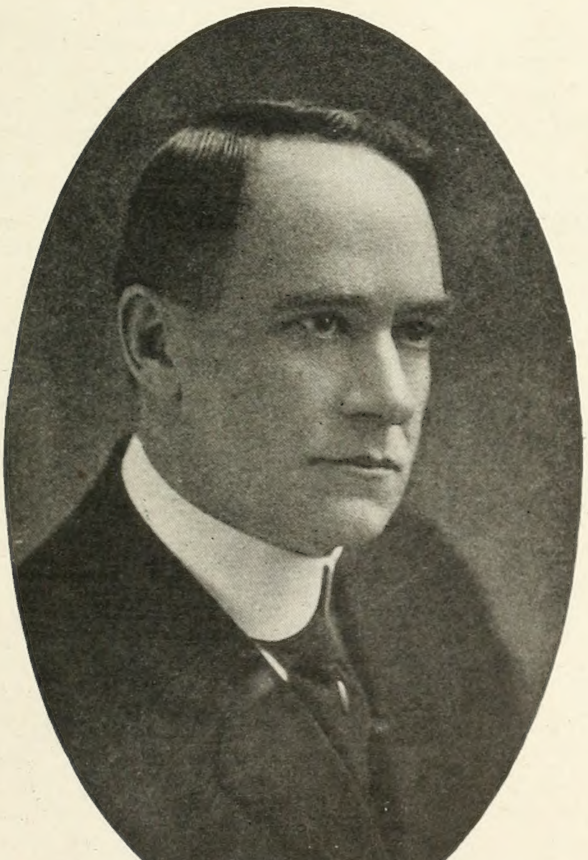
VOLUME I. JANUARY, 1921. NUMBER 1

Canadian Journal of Agricultural Science

Scientific Agriculture



L. S. KLINCK,
President of the Canadian Society of
Technical Agriculturists.

and

La Revue Agronomique Canadienne

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Scientific Agriculture

Official Organ of the Canadian Society of Technical Agriculturists
A Magazine devoted to the general advancement of Agriculture in Canada.
Published in the interests of Agricultural Science and Research.

Vol. I. Gardenvale, P. Q., January, 1921. No. 1.

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Published Monthly by the Industrial and Educational Publishing Company, Limited, Garden City Press, Ste. Anne de Bellevue, P. Q. 'Phone 165.

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Editor and General Secretary—FRED. H. GRINDLEY.

Subscription to any address in Canada, the United States, or the British Empire, $2.00 yearly; other countries, postage extra.

Changes of advertisements should be in the Publishers' hands ten days before the date of issue.

La Revue Agronomique Canadienne

PAGES 43-52

:-: EDITORIAL :-:

HISTORICAL SENTIMENT.

Doubtless every new publication that is launched into the field of periodical literature has, as its opening editorial, something intended to be of interest either as a prediction or at least as a sentimental reference upon which future editors may look back. It would seem to be inconsistent if we did not, in giving our readers the first number of "Scientific Agriculture", keep to the path of precedent.

The field which this magazine will cover is quite apparent from its title; its purpose, too, is plainly to gain recognition for agriculture as a scientific industry; its usefulness will be decided and directed by the individual readers.

Our first editorial is an open hand extended to greet all movements, all institutions, devoted to the advancement of agriculture in Canada. We are all working as a cohesive whole towards the same end and seeking to obtain recognition and sympathy on the part of the public for that work. It is a difficult task, because we include in the term "public" many people interested in industries remote from, even if dependent upon, agriculture. Yet we can see a trend in the right direction, and the purpose of this new magazine is to foster and aid what has already been undertaken.

As the official organ of the Canadian Society of Technical Agriculturists, our columns will naturally give publicity to the work which that organization is doing. The articles published will, as far as possible, treat with the educational, scientific and more progressive phases of agricultural effort. Certain pages will perhaps appear to be of primary interest to members of the C. S. T. A., but the general reader will find much information in those pages that is of equal interest to him.

We particularly desire to co-operate with the present existing agricultural press, and to assist them in any way possible. We do not intend to be competitive, nor to trespass severely upon the ground which they are already covering. We feel, however, that there is a place for a magazine which can represent technical agriculture in this country and we feel certain that no existing publication will dispute that claim, or hesitate to welcome this venture.

For these reasons we will gladly permit the free use, by any other journal, of the material published in "Scientific Agriculture", provided, of course, that we receive fair credit for it. And we hope, if there should be matters upon which we can aid the agricultural press, or upon which we can perhaps be of mutual assistance, that none will hesitate to suggest them.

So our first editorial goes into history. It is written, literally "under the desk lamp," in a spirit of genuine sincerity. It must not be devoid of sentiment. We have a keen personal interest in the Canadian Society of Technical Agriculturists and we cannot permit the first issue of its official organ to go to press, without wishing it success ourselves, even if such a wish may be attributed to selfishness and sentiment.

THE WESTERN CANADIAN SOCIETY OF AGRONOMY.

On December 28th, 29th and 30th last, a very notable meeting was held at the University of Alberta in Edmonton, when the Western Canadian Society of Agronomy met for its first annual convention. The place which that organization will fill in Canadian agriculture is an important one; its importance will increase as its work becomes more known, and as its scope widens. For a society that has been in existance only a little more than one year, the programme carried out at the recent meeting is one which reflects special credit upon those who planned it and upon those who, as participants, were even more directly responsible for its success.

Comparatively few people realize or fully appreciate the relationship between science and agriculture, in spite of the fact that agricultural research and experimental work have been conducted in Canada for many years and in practically every community. Valuable results have been obtained and these in turn have given to practical agriculture an impetus sufficiently strong to warrant, many times over, the expense involved or the time taken in the obtaining of those results. And yet it is questionable whether many of the Canadian people who are directly affected, know when or how or by whom the pioneer work has been done, what its direct bearing is upon present agricultural methods or what the experimental work now going on may mean in the next decade.

The Western Canadian Society of Agronomy will help materially to relieve this lamentable condition. In the western provinces where the influence of this new body will be more dirctly felt, the production of cereals is increasing at a comparatively rapid rate. Every setback which the grain growers meet, either from drouth or rust or locusts or from whatever causes, means a national loss running into millions; sim-

ilarly the preventive measures put into successful operation, or the introduction of new varieties, new methods, new machinery, means a corresponding national gain. The meeting together of men engaged in scientific agronomical work, the discussion of problems of mutual interest, and the dissemination to the farmers of the conclusions reached, cannot fail to benefit, in a very marked degree, the agriculture of the prairie provinces.

EDITORIAL BOARD.

In view of the fact that articles will be submitted for publication in "Scientific Agriculture" which will deal with the more advanced phases of agriculture, it is considered advisable that an Editorial Board should be appointed to serve as a consultative body. There are at least ten, and probably more, main divisions of agriculture, including animal husbandry, bacteriology, botany, cereal husbandry, chemistry, dairying, entomology, genetics, horticulture, veterinary science, rural economics and rural engineering. No one person is competent to pass upon the merits of technical articles covering such a wide range of subjects.

The matter is now being taken up by the Dominion Executive Committee of the C. S. T. A., through its general secretary, and it is proposed to appoint two experts in each of the above named subjects to serve as an editorial board and to take office as soon as possible, probably before the end of February.

There are a number of important features to be considered in selecting the personnel who will con-Canada, that board. In a country as far—flung as Canada, considerable time is necessary in order to permit the absence of articles from the point of publication and to provide for necessary delays before their final return. This means [that consideration should be given to distances from point of publication and to the appointment of men who are known to be systematic and reasonably prompt in the conduct of such work. Then, too, the greatest care will have to be taken to select men who are recognized as authorities in their respective lines; otherwise there would be considerable merited criticism coming from contributors, who might question the qualifications of the appointed Board.

In spite of these difficulties, and others which will present themselves, there is much to be said in favor of the proposed arrangement. The duties of the Board need not be onerous, as only a comparatively small amount of material will be submitted annually to any two members of it; at the same time it will prevent the publication of material not considered to be reliable, or results not representing adequate experimentation, or statistics quoted from questionable sources. And, finally, it will relieve the Editor of too great responsibility in the case of articles not accepted for publication.

FRENCH SECTION.

As soon as an official organ was mooted it became necessary to give recognition in some way to the French speaking members of the C.S.T.A. and the question of a French section was at once considered. It was felt, by the publishers, however, that from a commercial point of view it would be more desirable to have two separate magazines, one published in English and one in French, the latter of which would be under the management of a representative of the French members of the Society. Recently, however, the editor, and his advisers in this matter, considered it more satisfactory to give the French readers all material received for publication, both in English and in French. It was therefore decided to publish only one magazine, which will include "La Revue Agronomique Canadienne" in the French language, edited by Professor Letourneau, who had already been appointed to edit the separate French magazine.

We shall be happy to receive from our readers any suggestions in regard to the present arrangement and if it proves to be a step in the right direction we shall feel that we are taking the initiative in a matter that has always been more or less controversal. Should we find that the publication of any French pages in "Scientific Agriculture" is not welcome it may be necessary to revert to our original plan and publish a separate magazine, but we cannot believe that such will ever be necessary. In this connection it is interesting to have the opinion of men like Dr. Charles E. Saunders, Dominion Cerealist, who in a recent communication upon this question expressed himself as follows:

"I believe that what the French members want chiefly is the courteous recognition of their native language rather than its constant use. Probably all the French subscribers would be competent to read the English articles, and would be well satisfied to read them in that language.

"Would any English-speaking people be offended, or would any English-speaking subscribers be lost because of a French section appearing in each issue? Certainly very few. I hope none. Foreign subscribers would not object and neither would the educated English-speaking readers — who will certainly constitute the bulk of the subscribers.

"Let me emphasize my belief that the printing of a French section in each number would not only be far less expensive, but would give better satisfaction to the people of Quebec, and would also contribute towards the development of that spirit of fraternity, between the French and English sections of the C. S. T. A., which is so desirable."

Communications from other readers of this magazine will be welcome.

A Study of the Influence of the Root System in Promoting Hardiness in Alfalfa

PROF. W. SOUTHWORTH, Agricultural College, Winnipeg.

(Read before The Western Canadian Society of Agronomy and published through the courtesy of that Society)

The rapid increase in the areas devoted to the growth of Alfalfa on the North American continent together with the introduction of the many various strains by the U. S. Department of Agriculture has enabled field experimenters to obtain a practical acquaintance with the great diversity of plant types to be found in the various strains of Alfalfa now under cultivation. These variations are exhibited not only in habit of growth, yield, seeding properties, and quality; but also with respect to the power possessed by certain strains to resist low temperatures in winter and fluctuating temperatures in spring and autumn.

It is with respect to the latter quality; viz., hardiness, that we wish to deal and especially with hardiness which seems to be due to, or at least is closely associated with, particular forms of root systems.

Historical Résumé.

The desirability of having strains of Alfalfa which will withstand severe cold in winter and maintain a good stand throughout a series of years has long ago been recognized by observant agriculturists.

Jethro Tull known as the father of horse-hoeing husbandry, who wrote in the first half of the 18th century, examined and noted the variations in the root system between different types of Lucerne plants (7). (Lucerne is the name given to Alfalfa in Europe).

In his book on page 291, Tull says: "Though one Lucerne root be much more taper than another towards the upper part of it, it is sometimes seen that a single hoed plant of it has many of these perpendicular roots, some of them springing out of the very branches of its crown." Again on page 298, Tull describes how he dug out the earth around a Lucerne plant, "to observe the manner of its taproot and then the earth was thrown in again and the hole filled up."

Referring to the results of his emperiment, he says: "It is probable this plant sent out immediately new fibrous horizontal roots which did grow apace to extract the nourishment from this new-made pasture, in proportion to the quick growth of the stalks which, in summer, have been measured and found to grow in height three inches and a half in a night and a day; this being almost one inch in six hours."

Another early observer, M. Lullin de Chateau-vieux, Geneva seems to have repeated Tull's experiment. Writing in 1759 to M. Duhamel du Moncear, Paris (4), he describes on page 358 how he uncovered the plants which were below ground: "That I might be able to judge of their general state."

In describing the conditions of transplanted Lucerne, he says: "The stalks seem to rise out of the earth; and from the first time of cutting them, a kind of head forms just above ground, which extends itself every year.... as many of them have grown so as to touch one another, their crowns have become of an oval form, having extended themselves on the sides where they met with no resistance."

(7) Figures in brackets refer to lit. cited on page 9.

Another authority, the celebrated author and traveler, Arthur Young, in his "Annals of Agriculture" (8) refers to observations made by Thomas LeBlanc, in 1783 on what he termed variegated Medick which was greatly preferred to Common Lucerne.

LeBlanc says: "My reasons for preferring it (variegated Medick) to Lucerne are that it is hardier in bearing cold; that from its habit of branching below the surface of the ground, and the shoots being much more numerous, it is not choked by natural grasses; and that for the same reason, it will not be injured by being fed by sheep."

Experiments were conducted by LeBlanc to compare the crop-producing powers of his hardy variegated Medick with Common Lucerne which proved that as regards producing bulk of crop, the variegated was decidedly the better; though he did not consider it so succulent as the Common Lucerne.

The writers and experimenters referred to above were evidently men of ken observation with discriminating insight; and it seems remarkable that their valuable contributions to the study of the Lucerne plant should have been forgotten or otherwise so long ignored by agriculturists and botanists who succeeded them.

Though there appear to be few recorded observations regarding hardy strains of Alfalfa during the 19th century; yet we know that on the American Continent the question was receiving the attention of practical farmers.

In 1857, the strain of Alfalfa now known as Grimm was introduced into Minnesota by the German immigrant farmer, Wendelin Grimm (2). This strain, owing to its hardiness and good cropping properties, has gradually spread through many of the northern and north-western states of America; it is also found in most of the Canadian provinces, and is now recognized as being probably the best known strain we have for withstanding severe winter conditions.

Some thirteen to fifteen years after the introduction of the Grimm strain into Minnesota, the Alfalfa known as Ontario variegated was introduced into the Niagara district in Canada.

It appears that about 1871, a farmer named Bethel who was then living near St. Catherines, obtained a sample of Alfalfa seed from a German shepherd who brought it from his native country. A few years later, in 1875, Dr. Cellyer, a medical man, who was then living at Welland-port near Niagara also secured a sample of seed from Germany.

Both strains had variegated flowers. As to whether there was originally any decided difference between the two in point of hardiness, variegation, or productive capacity, there does not appear to be any authentic evidence on record.

If there were any differences in the strains when first imported, they appear to have become obliterated; prob-

ably owing to the strains having become mixed when grown by various farmers in the district, and now the two strains appear to be merged into one and are known as Ontario variegated.

It may be stated here that the Grimm Alfalfa and Ontario variegated have many points in common; in both strains, a fair percentage of plants are found, which have variegated flowers, both yield heavy crops, and many plants are found having branched tap-roots, also some plants produce vigorous rhizomes.

These distinctive rooting characteristics give hardiness to the plant and enable it to withstand severe winter conditions without much risk of being readily killed out.

The establishment of the Grimm and Ontario variegated strains had a decidedly beneficial influence on the spread of the culture of Alfalfa. For a time, the effect was somewhat localized and largely restricted to the respective districts into which these strains were first introduced.

As the value of the strains for hardiness and cropping power came to be better known, a keen demand for seed was firmly established; and at the present day, true samples of either Grimm seed or Canadian variegated have a high commercial value, and the local demand for seed of Canadian variegated is much greater than can be met by the limited supply.

The greatest stimulus given to the culture of Alfalfa on the North American continent and the dissemination of a knowledge of the principal hardy strains was, however, brought about owing to the question being taken up in such a thorough manner by the U. S. Department of Agriculture.

Writing on this subject, C. J. Brand (1) says: "During the period that elapsed from May 1898 until November 1904, forty-two strains were introduced from different parts of the world: fifteen came from Turkestan; other strains were the Province Poitou and Sand Lucerne. Since the autumn of 1904, nearly two hundred numbers have been introduced from various parts of the world; in addition a large number of more or less distinct strains have been secured from various parts of the United States, and a still larger number have been obtained by propagation of seed from previous introduction. All of these domestic and foreign races and their progeny constitute the richest material for the study and breeding of Alfalfa ever brought together."

Seed of these varied forms of Alfalfa has been distributed to many experiment stations in the United States where the great diversity of soil and climate furnish abundant opportunity for comparing the many varieties under a great range of conditions. Samples of seed have also been distributed to experiment stations in Canada.

The experiment station at the Ontario Agricultural College, Guelph, receeived over sixty samples: these were sown in the spring of 1909; and from the resulting crop, the writer has had the opportunity of studying the characteristic of the strains as a whole, and also of making a more exhaustive study of selected plants from the principal strains.

Résumé of the Results Obtained by Workers in the United States on Hardy Alfalfa.

The references already made to the observations and experiments made by Tull, Lullin, and LeBlanc indicate, in some measure, the effect the root system may have in enabling Alfalfa to succeed under varied climatic conditions, and also when grown in competition with other plants.

Within the last few years, interest in this matter has been revived with the result that some attention is now being devoted to the study of the varied root systems found in different strains of Alfalfa. The question has been studied independently by several investigators, and the results already obtained furnish evidence to show that information of much economic importance is likely to result from their researches.

In making a brief survey of the work done during recent years, we find that C. J. Brand and L. R. Waldron discussed the hardiness of Grimm Alfalfa in a U. S. bulletin in 1910 (1).

In this work, the authors suggested "the possibility that the long endurance of stands of the Grimm strain may be due in some measure to a capacity for putting out new roots and re-establishing itself after the tap-root is broken. The data collected on this point do not yet justify anything like positive statements, but it is mentioned in this connection to stimulate growers and breeders to make note of similar conditions."

The following year, 1911, Philo K. Blinn, of the Agricultural Experiment Station, Colorado, published the results of some original investigations on the characteristic rooting habits of hardy types of Alfalfa.

The results described by Blinn amply justify the suggestions made by Brand and Waldron; and the author shows clearly that hardy strains have spreading crowns which seem to be associated with a very much branched surface root system in addition to the deep tap-root.

In 1913, G. W. Oliver, of the U. S. Department of Agriculture, published a valuable contribution to our knowledge of varied rooting types of Alfalfa (6). In this bulletin, he describes very fully two types of undergrounds shoots or rhizomes which he terms rooting and non-rooting; and explains in detail their origin, structure, and functions in the economy of the plant.

In a circular (5) published in 1913, R. A. Oakley and S. Garver (U. S. Department of Agriculture) described in detail another type of root growth which they term "Root-proliferation" which is taken to mean the development of aerial shoots in an abnormal manner from the true roots of the plant. This form of growth, the authors observed in 1912 on specimens of yellow-flowered Alfalfa (Medicago falcata); and full description is given of the main features of this peculiarity of root growth.

Main Features of the Writer's Investigations.

This study of the rooting system of Alfalfa was not entered upon in accordance with any pre-determined scheme, as at the commencement of the work the writer was not aware of the existence of any record of similar work having been done by any previous investigator.

The influences which led up to the inception and development of the work were as follows:—

> It was in the summer of 1911 whilst working on a series of plots of Alfalfa that the striking variations in the rooting systems were particularly noticed.
>
> These plots were located at the experiment station connected with the Ontario Agricultural College, and were seeded down with about seventy different strains of Alfalfa obtained mainly from the U. S. Department of Agriculture.

In this collection of strains, the growth above ground showed many striking variations with respect to flower color, habit of growth, seeding properties, and size and vigor of individual plants.

As the study of these plots proceeded, it was found necessary to go over the crop so as to root up any superfluous plants which would interfere with a study of individual plants.

In carrying out this work, a practical acquaintance was obtained of the characteristics of the Alfalfa plants below the ground line.

In the course of our observations, it was noticed that the crowns of different plants presented great variations; some were broad and spreading, producing many stems and buds, and usually having a branching root system. The majority of the plants, however, had small crowns with a less tendency to spread, and produced proportionately a small number of stems; these plants usually had either a single taproot, or one only slightly branched.

These preliminary observations were used as a basis for further investigations; and, in order to present an account of the diversified forms of roots examined, an attempt will be made to arrange the different root systems into three main types under the headings A, B, C.

Type A.—True root system without underground stems (2 forms).

1. Single tap-root.
2. Branched tap-root.

Type B.—Branched tap-root together with the development of well-defined underground stems.

Type C.—Branched top-roots with buds and aérial roots as distinguished from the underground stems in Type B.

Description of the Three Types and Subtypes.

Type A.—The true root systems of the various plants varied very markedly, and two well-defined forms were examined.

1. The single tap-rooted form was by far the most common: this consists of one main tap-root from which arise numerous small lateral roots.

2. The branching tap-root. In this form instead of there being only one main root, the tap-root develops into several large roots. The branching usually commences either immediately below, or a short distance below, the base of the crown, and the various branches at first usually grow out in a lateral direction, but later take a more vertical downward course into the soil.

Figure 1.—Root System—Type A. 1. Single tap-root 2. Branching tap-root.

Figure 2.—Branching Roots of a Special Plant. Selected for hardiness and seeding properties. This is a third generation plant from Sand lucerne.

Comparisons were made between the stems and foliage of the plants having the different root systems, and the superiority of those having branched roots as compared with the single tap-root was very striking, being usually much more vigorous and healthy in growth, and consequently yielding a much heavier crop.

This examination though it was regarded as being only of a preliminary nature yet was sufficient to furnish convincing evidence that in any attempt to improve the strains of Alfalfa, the character of the root system should be considered to be of primary importance.

One of the greatest advantages to a plant having a branched root system over the single tap-root is the much firmer anchorage it gives to the plant: thus enabling it to resist far more effectually any tendency to be heaved out of the soil by winter frosts and spring thaws.

It is a fact well-known to Alfalfa growers that one of the most common causes of failure to retain a good stand is not so much the low temperatures experienced during winter as the alternate freezing and thawing which may occur in the spring. The Alfalfa is heaved out and the roots exposed in such a way that a comparatively light frost is sufficient to destroy the majority of the plants. It is under such conditions that the plants with the branched roots are seen to great advantage.

This was clearly demonstrated in the spring of 1914. The previous winter, though no very low temperatures were recorded, proved to be very severe on Alfalfa both on the newly sown fields and also on those well-established, many good stands being killed out.

The chief reason for this was the unusual amount of alternate freezing and thawing during the winter and spring which heaved out the plants, thus exposing the roots to spring frosts and drying winds.

On the experiment plots seeded down in 1912, it was found that those plants having a single tap-

Figure 3.—Heaving of Alfalfa in Spring. The crown of the plants with single tap-roots are pushed out several inches above the surface of the soil.

root were practically all heaved out of the soil, some having their roots lifted and exposed above the surface of the ground for over four inches whilst those few plants having branched roots were so firmly anchored that they had suffered comparatively little from heaving.

It may be pointed out that the heaving of the tap-rooted plants was not owing to any shallowness of the roots, as after the thaw, it was easily possible to draw out plants with roots two feet in length. On the other hand, it was almost impossible to draw the plants which had branching roots, and in the attempt the stems were usually broken off near the surface of the soil without dislodging the roots.

In the course of observations made at a later date on mature three-year-old plants, specimens were found, which, in addition to having the branching root system referred to above, had the property of producing lateral buds from the rootstock which subsequently developed into rooting underground stems or true rhizomes.

These are classified as type B.

Type B.—In this type, the buds which give rise to the underground stems are produced at the base of the crown just underneath the surface of the soil, and apparently are formed mainly in latter part of summer and early autumn.

As the buds develop, the shoots produced take an oblique downward course into the soil and continue to grow in this direction during the autumn until land is frozen hard and growth ceases.

If the land is fairly dry and the soil is not disturbed, these white and apparently tender shoots do not appear to suffer from hard frosts, and when growth commences in the following spring, the growing tip of the underground stem gradually curves upwards towards the surface of the soil and eventually emerges above ground sometimes from six to nine inches distant from the point of contact with the parent crown.

The young stem continues to grow, and rapidly develops into a true aerial stem producing foliage and flowers like the parent, and has all the appearances of being a distinct plant.

If we examine the part of the stem underground, fine, fibrous roots will be found arising from the under-surface; thus forming a well-defined rhizome capable of developing into a distinct plant and having the power of maintaining a separate existence and quite independent of the parent crown.

From this explanation, it will be seen that if the main crown of the plant should die from injury or other cause, the life of the plant may be continued by the young plants formed from the fully developed rhizomes.

Hence, it will be readily understood that old Alfalfa plants having the power of producing rooting underground stems will have the ability to renovate themselves by the production of a new crop of young plants, and for this reason will be much more resistant either to winter frosts, competition with other plants, or to injury by the grazing or treading of cattle, and will consequently, under normal conditions, maintain a good stand for many years.

Type C.—In the autumn of 1912 whilst examining the rooting habits of yellow flowered Alfalfa (Medicago falcata) a type of root was found, which differed very materially from any of the forms already described under types A and B.

This form seems to correspond very closely with those found by Oakley and Garver in 1912 and described by them in a bulletin published in 1913.

During the course of our inspection, several plants were found on which buds and aerial stems were produced on the true roots. In some cases, stems were found arising from roots at points six to eight inches below the surface of the soil.

In this type, the root system as a whole may be considered as being made up of branched roots, some of which penetrate the soil in a vertical manner and from which strong lateral branches are given off.

These lateral roots frequently arise from the main root at a point several inches below the surface of the soil, and may travel for long distances in an almost horizontal direction.

Near the point where the laterals leave the main root, the lateral may be comparatively thin; but further away, thickened areas frequently occur. In some cases, the thickening is quite irregular, in others it is of a fairly regular spindle-shaped form.

On some of these spindle-shaped swellings, buds are produced, which develop forming the aerial shoots, and from the same swelling, a root system is produced similar to that of the parent plant.

The spindle-like thickenings are not confined simply to the lateral roots; but are likewise found on those growing in a vertical direction.

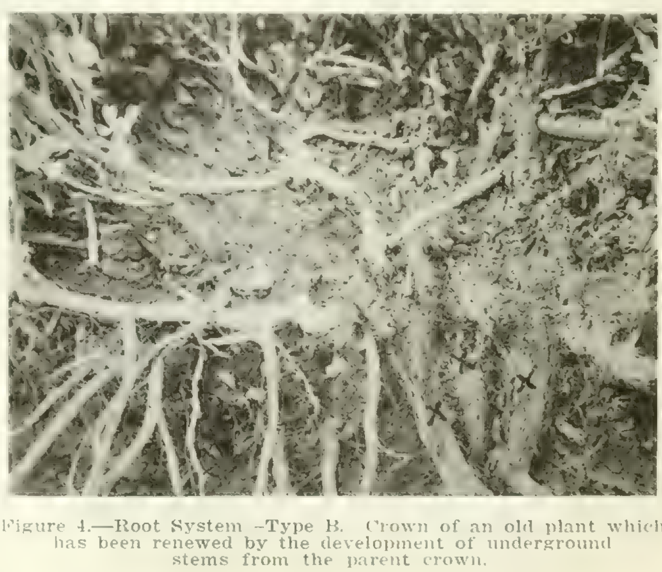


Figure 4.—Root System -Type B. Crown of an old plant which has been renewed by the development of underground stems from the parent crown.

x Dead tissue of old ROOTS.

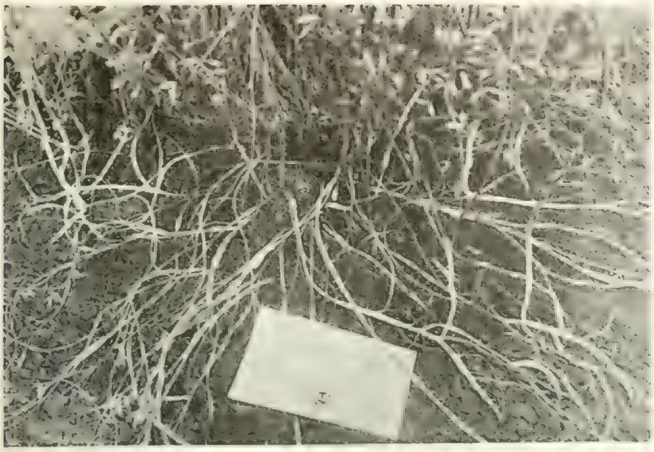


Figure 5.—Root System—Type C. Certain plants of yellow-flowered Alfalfa may spread by means of buds produced on the true roots somewhat after the manner of perennial Sow Thistle.

Some of the vertical roots end abruptly, forming a swelling from which arise numerous small fibrous roots. The lateral roots also sometimes end in swellings; but in these examples, the swollen portion usually gives rise to both buds and a true root system; thus forming what may eventually become a distinct and independent plant.

From the above description, it will be readily seen that the spreading nature of the lateral roots, together with the formation of adventitious buds and shoots enables the plant to spread and multiply in a very rapid manner; this would lead one to conclude that such a plant would have the power to retain its hold on the land permanently, very much after the fashion of perennial sowthistle and similar weeds. Moreover, the roots which penetrate in a vertical direction give to the plant valuable drought-resisting properties; and it would appear that when thoroughly established such plants might, under average conditions, be expected to produce profitable crops without serious loss of stand over a long series of years.

In summarizing the main points brought out by the observations and investigations described above, it would seem that.—

I.—The hardiness of Alfalfa, that is capacity to withstand severe winter conditions, depends very largely on its root system.

II.—Plants possessing a branched root system are much better able to withstand winter heaving than those having only a single tap-root, no matter how great its length may be.

III.—Those plants which have the power to produce rooting underground stems are able to renovate themselves, and after the death of the main root-stock are capable of keeping up a separate existence quite independent of the parent root-stock.

IV.—When Alfalfa has the habit of spreading by means of root proliferation, we have a form of spreading and multiplying in a vegetative manner which promises to give to the plant greater powers of resistance to cold and also greater powers of recuperation from injury than is possessed by even true rhizomes; and we venture to hope that these properties will render it possible to grow good crops in adverse climatic conditions under which it would be quite impossible to raise common Alfalfa.

Though we may regard this rooting habit in the falcata species as being of immense importance in insuring hardiness; yet we find that the plant is usually deficient in other qualities; those plants already isolated and studied are distinctly inferior to common Alfalfa both in seed production and in the quality of the foliage either for hay or for pasture.

Usually, the stems are thin and wiry, and they very quickly become hard and woody, which condition renders them less nutritive and less palatable for feeding purposes.

These defects, it must be admitted, are very serious; and with a view to remedying them experiments at the Manitoba Agricultural College are now in progress.

Mother plants specially selected for hardiness have been cross-fertilized with pollen from selected plants less hardy but possessing good seeding properties.

Past experiences have shown us that the seeding ability of Alfalfa is very elusive and exceedingly difficult to control, and apparently is not so readily transmitted by cross-fertilization as the strictly vegetative characters of the plant.

These experiments on cross-fertilization represent another phase of the work directed towards the improvement of Alfalfa; but with such a plant as Alfalfa, investigation of this nature must necessarily be slow and long drawn out before a report of a definite and reliable nature can be presented.

References to literature on this subject.

(1) Brand, C. J. and Waldron, L. R., Cold Resistance of Alfalfa and Some Factors Influencing it. U.S. Department of Agriculture, B.P.I. Bul. No. 185, 1910.

(2) Brand, C. J., Grimm Alfalfa and its Utilization in the North-West. U. S. Departmen t of Agriculture, B.P.I., Bul. No. 209, 1911.

(3) Blinn, Pihlo K., Alfalfa, the Relation of Type to Hardiness. Experiment Station, Colo., Bul. No. 181, 1911.

(4) Monceau du Duhamel, H. L., A Practical Treatise of Husbandry, London, 1759

(5) Oakley, R. A. and Garver, S., Two Types of Proliferation in Alfalfa, U.S. Department of Agriculture, B.P.I., Circ., No. 115, 1913.

(6) Oliver, G. W., Some New Alfalfa Varieties for Pastures, U.S. Department of Agriculture, B. P.I., Bul. No. 258, 1913.

(7) Tull, Jethro, Horse-hoeing Husbandry, Cobbets, Ed., London, 1829.

(8) Young, Arthur, Annals of Agriculture, Vol. XV, 1791.

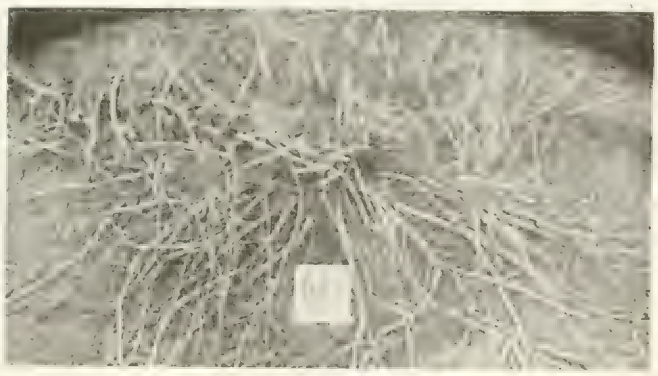


Figure 6.—Root System of a Albert Hybrid, being a cross between violet-flowered [illegible] owered Alfalfa

Falfalfa.

The History, Progress and Future of the C.S.T.A.

By the GENERAL SECRETARY.

On the evening of Friday, October 10th, 1919, five men met in a small room in Ottawa. They were the original organizing committee and they discussed for several hours the possibility of organizing a society in Canada which would include in its membership all men engaged in scientific, administrative, experimental or investigational agricultural work in Canada, or in any work of a similar nature. At the close of that first meeting a tentative name for the prospective society was adopted—The Canadian Society of Technical Agriculturists—and the writer was appointed Secretary-Treasurer. The chairman was M. B. Davis and the other members were G. LeLacheur, F. L. Drayton and F. E. Buck. At that time the society did not contain a single member.

During the remainder of 1919, lists of eligible members were obtained from various sources and on January 9, 1920, an organized membership campaign was undertaken. Circulars were prepared giving (1) the aims of the Society; (2) the probable constitution; (3) the names of those who had already endorsed the movement. Provincial organizing committees were also appointed. As the membership increased, the lists of members were forwarded to eligible non-members, a plebiscite was taken on the name of the Society, and on the date and place of the organizing convention; nominations were received for the offices of president, vice-president and honorary secretary. An attractive programme for the convention was drawn up, printed and distributed. Following the receipt of nominations, a dominion-wide election was carried on by mailed ballot, in co-operation with the Proportional Representation Society of Canada.

From the foregoing it will be readily appreciated that the Organizing Committee was particularly busy during the period from January 9th to June 2nd, when the Convention opened in the Chateau Laurier, Ottawa. The growth in membership during the period of organization was as follows: January 31st, 77; February 29th, 120; March 31st, 174; April 30th, 311; May 31st, 411.

It was unfortunate that all this preliminary work was carried out during a period when the re-classification of the Dominion Civil Service was causing considerable dissatisfaction. It gave the C. S. T. A. the appearance of being an outgrowth of re-classification and created a temporarily difficult obstacle. Another difficulty arose on account of all the members of the Central Organizing Committee being graduates of Macdonald College, and this was only remedied to some extent by the appointment of Provincial Committees. Other minor obstacles were met from time to time but practically all of these were suggestive of new methods of organization and in the end proved to be constructive.

And so we cover the organization period in a very hurried sketch, and arrive at the Convention. It need not be dwelt upon at length. The election of the present officers was ratified, the constitution and by-laws embodying the objects of the Society, were adopted, and a Dominion Executive Committee was appointed which, in turn, employed a General Secretary-Treasurer. Excellent addresses on many varied subjects were given,

CANADIAN SOCIETY OF TECHNICAL AGRICULTURISTS
Group taken at the Central Experimental Farm, Ottawa, during the Organizing Convention.

resolutions passed and committees appointed. It was decided to hold the next Convention in June 1921, in Winnipeg.

A detailed report of the Convention, including the report of the Organizing Committee, is available for those who have not received it. Copies of the Constitution and by-laws, etc., may also be obtained on application. The names of the officers elected, and the members of the Dominion Executive Committee are given elsewhere in this issue.

After the Convention had adjourned, practically all of the work resulting from the formation of the C. S. T. A. had to be carried on by the General-Secretary, in consultation with the Dominion Executive and with the chairmen of the various committees which had been appointed. One of the first matters requiring attention was the possible publication of an official organ. After some correspondence and a number of interviews an arrangement was effected between the Dominion Executive and the Industrial & Educational Publishing Company whereby that company agreed to publish the organ of the C. S. T. A. There were a number of details in regard to the transaction, the most important of which were (1) that the Society should have control of the editorial policy and make-up; (2) that the General-Secretary should be the Editor; (3) that the name of the publication should be "Scientific Agriculture," and (4) that the publishers should own the magazine. As a result of this arrangement the General-Secretary moved his office from Ottawa to Ste. Annes, P.Q. on October 1st, and since that time has been filling the dual position of Secretary and Editor. Quite recently an arrangement has been made whereby the French members of the C.S.T.A., will prepare a section of "Scientific Agriculture" under the name "La Revue Agronomique Canadienne," to be made up of translations from "Scientific Agriculture," and additional information of primary interest to the French members. These arrangements with the publishing house are particularly satisfactory, and the members of the Society are assured of the closest possible co-operation between their organization and the publishers. It is particularly important, however, that in return for the courtesies which the publishers have extended to the C. S. T. A., there should be an effort made by the Society to make the publication of Scientific Agriculture and of "La Revue Agronomique," a successful venture and in that way insure their continuance as the official organs.

The work of organizing provincial and local branches of the parent society has also been a task which presented some difficulties and it was only completed to its present stage by the personal visit of the General-Secretary to the various provinces where he was able to meet individual members and proceed with organization work. At the time of writing, the only gap in the whole organization is in Western Ontario and it is hoped that this will be filled by a Western Ontario Branch at an early date. In all the other provinces there is at least one branch of the Society: in Quebec there are three local branches responsible to one provincial executive and in Saskatchewan there are two local branches whose operations are similarly directed.

The two lines of progress announced in the foregoing, namely the publication of the official organs and the completion of provincial and local organizations are the only matters of sufficient importance to warrant publicity at this time. Many other smaller results have been accomplished and the Society is making splendid progress. The membership has increased from 411 to

President L. S. KLINCK (centre), Vice-President H. BARTON (left), and Honorary Secretary, L. H. NEWMAN (right).

510 members whose distribution at the present time is as follows:

Alberta, 32; British Columbia, 49; Manitoba, 30; New Brunswick, 20; Nova Scotia, 20; Ontario, 171; Prince Edward Island, 12; Quebec, 129; Saskatchewan 40; United States, 7.

In regard to the future of the Society, much could be said but it is only necessary at this moment to outline one or two of the main objects for which the organization stands. There can be no doubt that the Society is needed. That is apparent from the mere fact that scores of progressive, far-seeing agriculturists in Canada have expressed in no uncertain terms their tribute to the organization of the C. S. T. A. Scores of letters are on file from men who are recognized as authorities, and this volume of correspondence would convince the most skeptical as to the need for an organized Society of those who are technically trained in agriculture.

President J. B. REYNOLDS (left) of Guelph, and DEAN E. A. HOWES of the University of Alberta, at the Organizing Convention

The Society should be able to do much to raise the whole status of scientific agriculture in this country and, as a result of that, the men who are engaged in agricultural work should benefit. It is unfortunate perhaps that quick results cannot be obtained but in an undertaking of this sort it should be readily understood that the results are cumulative and that they cannot be expected in a few months. It should also be possible for the Society to attract other scientific organizations and in that way to form affiliations that will strengthen the C. S. T. A. and add force to its policies. Through the official organs of the Society very much needed publicity can be given to scientific agriculture in this country and to the results of research work now being done either in Canada or in other countries.

There are a number of men eligible for membership in the C. S. T. A. who have not yet joined. This is somewhat of a barrier to progress and the Society can only make its influence felt and carry out perfectly the objects for which it has been formed when it includes in its lists of members everyone who is eligible.

Many difficulties have been met in the past twelve months. None of these have proved to be serious and there is not the slightest doubt at this moment that the Canadian Society of Technical Agriculturists will be a very important factor in the sane upward advancement of scientific agriculture in this country.

Do Our Agricultural Colleges Educate?

By Prof. B. T. DICKSON, Macdonald College.

The above title may be criticised by some but the term "Agricultural College" is here intended to represent the corporate body of the College,—the Governors and teachers.

At the present time a keen controversy is in progress between the two schools of educational thought—the "Humanistic" and the "Realistic." It is not within the province of an Agricultural College to decide upon the merits of Latin, Greek and Philosophy as compared with Science, since fundamentally the curriculum of such a college is scientific. But is does behoove us to consider whether our Agricultural Colleges are fulfilling the purposes which it is their duty to fulfil or whether they are lacking in some respect. This is all the more important when one sees the state of the world today, the chaos with Labour and Capital diametrically opposed, altogether selfishly forgetting the Public. On every hand we find institutions of learning begging for financial assistance and receiving only crumbs. Education is today a handicap in "making money." Are we to cry "mea culpa" in part or wholly? Individual and corporate introspection is necessary to answer this question.

To my mind the fundamental query is "Do we train our students to think?" The importance of this cannot be over-estimated and here it may be emphasized that "thinking" and "doing" are so closely related that they cannot be separated. How many of our students think logically, critically, and independently or, on the other hand, how many accept unquestioningly the facts as given to them by their teachers on the authority of others? The latter may be quite likely to come out at the top at examination time but the former is worth far more to the College and to the world. The absorptive type of student is the valuable type, and not the adsorptive, for the art of remembering is the art of clear thinking and not of pure memorization.

With true knowledge we are able to build, to acquire

more knowledge and thereby to build still more. In our educational institutions the teacher is the intermediary between the knowledge and the absorber of knowledge. It is his function to see that the knowledge is made available but it is impossible for him to function in the absorption of that knowledge. Many mistaken teachers try to do this by "spoon-feeding" with the inevitable results that the spoon-fed individual is a helpless incompetent specimen. The major fact that knowledge is power only when obtained by personal effort is entirely forgotten. How often one hears the lament "I am sure I explained it clearly enough!" The explanation may have been as lucid as possible but the unfortunate student either did not possess the necessary background of knowledge or he did not enter actively into the thinking participation. If the former is the case he should not be "taking" the subject, if the latter, the fault is with the system.

The average student comes to College, with a big "C," but does not know exactly for what he comes except that he would like a B.S.A. He knows he has to put in four years, take many hundreds of lectures and pass almost as many examinations. If he comes out alive, well and good. He grows from Freshman to Sophomore, to Junior and finally to Senior and Graduate, but that he grows commensurately in thinking ability is an open question as far as College education goes. It is usually after he graduates that the thinking begins and it is to be hoped he is charitable in disposition.

It is very easy to be critical destructively and such criticism is useless unless a remedy is offered, which the writer will attempt to do.

In laboratory exercises the last ten years has seen a radical change so that now it is usual to arrange a complete series of studies each of which entails careful thought and decision as to facts in relation to known or given facts.

But this cannot be said of lectures, in which there are common and outstanding faults. The student is given a body of facts, beautifully arranged perhaps, but involving the taking of voluminous notes (or none in despair). Later comes a recitation in the process of which the lecturer gets back his own words from the student. This has been well-described as a "cram and emetic" system.

There is absolutely no vitality in it and it is merely a mechanical preparation for the passing of the authorized examinations. It is an accepted fact among educators that there is no impression without corresponding expression, and that it is not in its apprehension but in its expression that a truth finally becomes a part of our body of knowledge. It follows from this that there must be a very active participation on the part of the student in the absorption of knowledge. Instead of being given a mass of facts which are usually indigestible and correspondingly discouraging he must be made able to handle the facts. The suggestion is offered that students deliver more "lectures" than the teacher. Certain topics may be directly assigned to specific members of the class, others may be general so that no student knows upon whom the office of lecturer will fall for that topic, and again the teacher may lecture without notice. The danger in too many assigned topics is that other members of the class will not prepare those topics. This is balanced by the second method of calling upon any member of the class. Then the lectures by the teacher interpersing those by the students should tend to show them the best way to handle a given topic.

There are some obvious advantages in this method. If a student knows that he may be called upon to discuss or explain a given fact or topic he will, in justice to himself, think about it. He will ask himself whether he understands it sufficiently well to explain it to his fellows. This wlll require more thinking and will give him new light on the subject. Ten minutes of such thinking will be of more value to that student than one hour of fact-cramming in a lecture, or fact-emitting in a recitation. He will be obliged to co-ordinate his ideas and handle them before the class, satisfactorily to the class. His fellow members will question him far more than they would the teacher as a rule. In case of difficulty the teacher is at hand to guide and suggest but not to spoon-feed. He will already have prescribed the necessary literature whether text, pamphlet or bulletin, etc., and it may be necessary to modify the prescription or add to it. In any case one serious difficulty, is overcome. We are very apt to forget our student days and our mental struggles when attempting to assimilate certain required subjects. Our perspective is now essentially modified by our added knowledge and try as we will it is impossible actually to assume the student's perspective. We take facts for granted and complete a lecture feeling that we have done creditably. Perhaps a week or more later we are asked a simple question showing that by taking the fact for granted we had made a mistake. By having members of the class try the explaining we see more the viewpoint of the student and should modify our ideas accordingly. This is especially necessary for those who, whilst still doing some teaching, are engaged on special research.

To my mind, altho' perhaps I am somewhat biassed, the success or non-success of a college in its educational function is shown by the use made by the students of its Library. Good and increasing use would be made of the literature available by the method suggested.

Finally this method would effectively do away with that joy of the dogmatic "scholasticist" and that bane of education—" the examination." Any teacher who could not determine whether his student was fit or not to pass on after that student had lectured perhaps ten or fifteen times during the term, should be laying bricks. In any case tests could always be set without prior notice and these would, in conjunction with the lectures and laboratory work, give a far fairer estimate of the students, thinking ability than a final examination.

Sir John Lubbock says of British education: "Our great mistake in education is, as it seems to me, the worship of book-learning — the confusion of instruction with education. We strain the memory instead of cultivating the mind."—(The Pleasures of Life).

This criticism is just as applicable to much of our Canadian education today.

BOTANICAL ABSTRACTS.

A request has been received from the Board of Control of "Botanical Abstracts" that the Canadian Society of Technical Agriculturists should participate in the management of that publication. The matter is now in the hands of the Dominion Executive Committee of the C. S. T. A. and it is likely that two members of the Society will be appointed at an early date to hold office for two and four years respectively on the Board of Control of Botanical Abstracts.

Dusts and Dusting for Insect and Fungus Control

By G. E. SANDERS and A. KELSALL,
Insecticide Investigations, Entomological Branch,
Ottawa.

PART 1.—THE PRESENT STATUS OF DUSTING.

A paper by Prof. H. H. Whetzel, Plant Pathologist, Cornell University, entitled "The Present Status of Dusting," was presented before the New York State Horticultural Society on January 14th, 1920. This paper contained a concise account of the problem spray versus dust, and a close analysis of the published experimental data of the last eight years. Inasmuch as the conclusions drawn are in accord with the experience of many progressive men in Canada, the writers feel that they will not be guilty of unnecessary duplication in submitting an article of similar character dealing more particularly with Canadian conditions, though utilizing several of the tables compiled by Prof. Whetzel.

Insects and fungi have undoubtedly troubled cultivators from the time when plants were first grown, and probably various materials and decoctions, both liquid and solid, were thrown upon plants for purposes of disease suppression as the cultivation of plants attracted attention. Probably early records could be obtained if sought for, but readily available records of the eighteenth century show the use of sprays such as lime-wash, tobacco water, sea water, and dusts such as sulphur, powdered quicklime and soot. Our modern conceptions of combined insecticides and fungicides orginate from two distinct sources, the first milestone in insecticides being the development of Paris green in America between the years 1860 and 1870 for combatting potato beetles; and the first milestone in fungicides being the development of materials for combatting diseases of the grape in France during the latter half of the nineteenth century. It is very notable that from 1860 to about 1885 insecticides and fungicides were, for the most part, applied as dusts. In America, Paris Green was diluted with flour, plaster, or ashes and dusted on the foliage, and though in some cases it was mixed with water and applied with a syringe, the great bulk was used as a dust. In France, sulphur was dusted on the vines to control the European powdery mildew. The change came about 1882 following the introduction into France of the American downy mildew. It was soon apparent that sulphur would not control this mildew, and this fact led to the epoch-making investigations of Millardet and Gayon culminating in the discovery of Bordeaux mixture. Bordeaux controlled the downy mildew readily and trials soon showed that it controlled many other diseases also, so that its use spread to all countries and suitable machinery was developed for applying it. It proved impossible to produce a good grade of Bordeaux mixture in dry form so that the practice of spraying with liquid increased and dusting declined. Consequently progress in the production of spraying machinery was rapid while corresponding improvements in dusting apparatus were not made. Thus the discovery of Bordeaux mixture was in no small measure responsible for the advancement of spraying and the decline of dusting.

But from the very beginning it was recognized that dusting possessed several distinct advantages. No person was more decidedly aware of this than Millardet. Coincident with his Bordeaux mixture investigations, he endeavored to produce similar copper compounds in dry form for dust purposes. Most of these entailed much labor in making, or did not possess necessary adhesive qualities, or were harmful to foliage. It is interesting to note that of the many powders he tried was one which contained anhydrous copper sulphate and air-slaked lime, and it is reported that he obtained the best results with this material. It is unfortunate that hydrated lime was unknown at that time, at least as a commercial product, for had Millardet had access to hydrated lime it is not improbable that the whole procedure of disease control would have been materially altered. As it was, Millardet failed to produce a satisfactory dust.

Consequently from about 1885 the standard and accepted way of applying insecticides and fungicides was as a spray. But during the intervening years, a gradual revolution took place in all agricultural operations, a revolution whereby one man did the former work of two men, a revolution brought about by the one thing, namely machinery. It became cheaper to do a maximum amount of work with machinery and a minimum amount with manual labor. It was impossible for this shifting of economic conditions to be without effect upon the operation of spraying. Large areas had to be covered in a short time with as little manual labor as possible, and this condition brought about a reconsideration of the problems of dusting.

The revival of dusting might be said to commence about 1912, and since that time considerable progress has been made in improved dusting machinery and in our knowledge of dusting materials. The present time therefore would seem very opportune for an inquiry into the present status of dusting.

Advantages of Dust over Spray.

The advantages of dusting over spraying have been reiterated in many articles, and have been generally recognized and appreciated by all familiar with the subject. They may be stated briefly as follows:

1.—Greater speed in application.

A dusting outfit is capable of treating from five to ten times as much orchard as a spraying outfit in a given time.

2.—More suitable timing of applications.

Owing to the rapidity of application the grower can time his applications to suit better the weather and the stage of the fruit.

3.—Less waste time.

Dusting operations should be done during weather unfit for most agricultural field operations, such as immediately after a rain or very early in the morning, while spraying operations require the best of weather.

4.—Lower cost of machinery.

The initial cost of a dusting outfit is two-thirds that of a sprayer, the cost of upkeep is less, the gasoline used is less, and the duster is a longer-lived machine.

5.—Lighter weight of dusting apparatus.

A dusting outfit with dust and operators does not weigh more than a third of the weight of a sprayer ready for operation, so that in spring it can be taken over hills or over wet ground upon which a sprayer would mire.

6.—Less liability to trouble and breakdown.

A dusting outfit in practice is a reliable machine and is not responsible for delays due to leaky valves, blowouts, etc., which always occur with a high pressure sprayer.

7.—The simplicity and speed of a duster makes a greater appeal to the grower.

More growers will dust than will spray, even if the total cost is the same, because it is less trouble. This is highly important, particularly in an orcharding community, where it is desirable in the interest of every individual to improve the standard of product of the entire community.

Of all these advantages the first and last named are probably the most important. As before stated these advantages are generally recognized by all. Why then the doubts about the status of dusting? These may be stated:

1.—Doubts as to the efficiency of dust in controlling,
   (a) Fungous diseases.
   (b) Biting insects.
   (c) Sucking insects.

TABLE I.—Results of four years experimental work in New York State.

For Year	No. Exps.	Unsprayed % Scab	Unsprayed % Worms	Unsprayed % Sound	Sprayed % Scab	Sprayed % Worms	Sprayed % Sound	Dusted % Scab	Dusted % Worms	Dusted % Sound	Spray-Lime-Sulphur & Arsenate of Lead. Dust-Sulphur and Arsenate of Lead.
1912	1	9.3	50.9	3.8	0.7	11.4	73.6	0.5	6.0	86.2	Cornell Bul. 340, p. 155.
1913	3	50.6	26.2	9.2	28.5	16.7	42.0	31.4	10.6	49.2	Cornell Bul. 340, p. 164, 173, 178.
1914	1	86.0	0.9	5.3	15.5	0.2	63.5	14.2	0.3	70.5	Cornell Bul. 354, p. 69.
1915	6	26.8	10.2	38.8	0.9	2.7	75.0	2.9	3.2	74.1	Cornell Bul. 369, p. 326, 333, 339, 342, 348, 350.
Av. of	11	43.2	22.0	14.3	11.4	7.8	65.9	12.2	5.0	70.0	

2.—Doubts as to the relative total cost.

Experimental Data.

Let us examine the experimental data available on the relative efficiency of sprays and dusts. Tables 1, 2 and 3, referring to the United States, are taken from the previously mentioned work of Prof. Whetzel. All experiments that are reasonably comparable have been included, where such experiments have been expressed in tabular form. The tables are presented here without comment, but for detailed explanations the original paper of Prof. Whetzel should be consulted.

To come now to experimental data in Canada, most results are reported in form not readily tabulated. In the proceedings of the Entomological Society of Ontario for 1916 and 1917, Professor L. Caesar (of Ontario) and Mr. C. E. Petch (of Quebec) both present results on dusting. To quote from Prof. Caesar's results of 1916, he says: "On each of the plots apple scab was well controlled. The liquid-sprayed part was a little better than the dusted, but not much. There is no doubt that fully 99 per cent of the fruit on the lime-sulphur and arsenate of lead plot was free from scab. The dusted part averaged, as nearly as we could judge, 97 per cent."

"Checks.—On the mountain side Baldwin trees averaged approximately 50 per cent scabby fruit, Golden Russets approximately 10 per cent. An examination of many trees throughout the district lead us to estimate that in general, unsprayed Spy trees were about 60 per cent infested with scab, Greenings and Baldwins about 40 per cent."

"Codling Moth.—My estimate made the first week in October for the total of the fruit both on the trees and on the ground was that it ran somewhere between 5 and 10 per cent with an average of probably 8 per cent. There was very little difference between the different plots."

"Check trees and poorly sprayed orchards nearby varied from 30 per cent to 80 per cent wormy with about 75 per cent of these entering at the calyx end. It is quite clear, therefore, that the dusting will control the codling moth satisfactorily."

Of results in 1917 he says: "In both liquid and dust portions on all varieties, even on Snow, there was less than 1 per cent scab. A snow tree in a neighboring orchard across the fence had over 90 per cent of scab and Baldwin and Greenings in it averaged about 50 per cent scab." Professor Caesar, however states that he is doubtful about obtaining the same results under different conditions.

Petch states of results in 1917: "This year was a very bad year for scab and we dusted and sprayed in order that we might test out both methods. The results were 99 per cent clean fruit on the sprayed portion and 97 to 98 per cent on the dusted portion. It was all done in one orchard, side by side, taking 90 trees in each portion."

Professor W. H. Brittain (of Nova Scotia) has conducted numerous dust experiments during the past several years. The results were never published, but his remarks based on them may be found in the last several Annual Reports of the Nova Scotia Fruit Growers' Association. In the 1920 Report pp. 79 and 80, Professor Brittain states: "In 1917 at the Annual Meeting of the Nova Scotia Fruit Growers Association, I summed up our experiments in Spraying vs Dusting as follows:

TABLE II.—Results of five years' experimental work in Michigan.

For Year	No Exps	Unsprayed % Scab	% Worms [1]	% Sound	Sprayed % Scab	% Worms [1]	% Sound	Dusted % Scab	% Worms [1]	% Sound	Spray-Lime Sulphur & Ar. Lead. Dust-Sulphur & Ar. Lead
1915	1	100.0	No data	0.0	49.1	No data	50.9	58.2	No data	41.8	Mich. Spec. Bul. 87, p. 5
1916[3]	3	100.0	No data	0.0	53.2	No data	46.7	94.9	No data	5.1	Mich. Spec. Bul. 87, p. 20
1917	3	99.9	No data	0.1	14.1	No data	85.8	10.5	No data	89.4	Mich. Spec. Bul. 87, p. 20
1918	2	28.2	14.0	67.1	5.4	0.7	92.8	1.8	0.16	97.1	Dutton letter, Jan. 29, 1902[2]
1919	1	62.4	10.0	21.6	15.2	0.1	84.2	12.6	0.00	86.9	Dutton unpublished data[2]
Av. of	10	77.7	12.0	15.8	27.4	0.4	72.1	35.6	0.07	64.1	Av. including 1916.
Av. of	7	71.4	12.0	19.7	20.9	0.4	78.4	20.8	0.07	78.8	Av. omitting 1916.

Note 1. Worm averages for 2 seasons only.

Note 2. Mr. Dutton of the Michigan Experiment Station very kindly allowes me to use his unpublished data for 1918 and 1919.

Note 3. In arriving at a just average of the Michigan data the results of 1916 should evidently be omitted as the authors own comments on that season's work indicate.

1.—Dusted arsenicals and sprayed arsenicals are both efficient if properly applied.

2.—Finely ground sulphur dust has a distinct fungicidal value, the percentage of control secured depening upon local and seasonal conditions.

3.—Under certain conditions, dusting may give as good control of apple scab as spraying, but under other conditions and especially against a severe natural outbreak, it is somewhat inferior."

Speaking of 1919 he says: "The past season was a very bad one for apple scab, nevertheless, a number of growers are known by the speaker to have obtained most excellent results from the use of 90-10 sulphur lead arsenate dust. We have examined orchards in which it would be hardly possible to better the results obtained by the use of any material. We have seen dusted and sprayed trees side by side in which the former were superior, though both were greatly superior to the untreated trees. On the other hand in our own experiments, though we have obtained satisfactory commercial control in some cases, in no case have the results been as good as regards control of apple scab, as have been those secured from either lime-sulphur or Bordeaux in approved strengths. In many cases they have been quite unsatisfactory.

The writers have had, at least with some dusts, similar experiences to those of Prof. Brittain, but at the same time have had many experiments where dust was superior to spray.

From Tables 4 and 5 it will be seen that as far as experimental data goes dusting has proved slightly more efficient than spraying, and these tables include, as stated before, all the readily available data which can be put in tabular form and which are reasonably comparable.

The dusts used in all the above experiments have as main constituents sulphur and arsenate of lead. But most of the experimental work of the writers has been connected with dusts having copper as the main fungicidal basis, and these experiments have not been included in the above tables. There is considerable reason to suppose, and this will be dealt with in a later article, that the copper arsenic dust as used in Nova Scotia has a considerably higher fungicidal value than 90-10 sulphur lead arsenate dust, at least in cool climates. In addition it must be remembered that in practically all the above experiments the dust was used at an unfair disadvantage. That is to say the dust was applied at regular stated intervals in the same manner as the spray, and this is decidedly not the best way to use dust to the best advantage.

Taking all these facts into consideration and regarding the matter purely from the standpoint of relative efficiency in (a) fungus control (b) biting insect control, it must be admitted that dusting wins.

There still remains the control of the sucking insect. On this point there are no experimental data, for it is generally conceded that while sucking insects can be controlled with spray, they have not been satisfactorily controlled with dust. But the problem is not incapable of solution. Professor Whetzel gives many instances of successful control with nicotine saturated dust. In Nova Scotia, Professor Brittain who has

TABLE III.—Results of four years experimental work in Illinois.

Year [1]	No. Exps.	Unsprayed % Scab	% Worms	% Sound	Sprayed % Scab	% Worms	% Sound	Dusted % Scab	% Worms	% Sound	Spray-Lime Sulphur & Ar. Lead, or Bordeaux and Ar. Lead. Dust-Sulphur and Lime and Ar. Lead.
1915[1]	2	87.5	9.0	No data	9.0	1.5	No data	7.0	1.0	No data	Ill. Hort. Soc. Trans., 1916, p. 262.
1916[2]	3	64.8	9.4	16.6	0.9	6.9	77.2	14.7	3.1	65.6	Ill. Hort. Soc. Trans., 1916, p. 262-263.
1917[3]	1	81.8	78.6	3.6	28.4	21.9	49.1	27.1	10.0	56.7	Ill. Hort. Soc. Trans., 1917, p. 170-171.
1918	1	67.6	83.9	5.2	37.8	4.9	53.9	30.9	20.0	63.7	Unpublished data by Flint[4]
Av. of	7	70.4	44.7	11.8	19.1	8.8	60.1	19.9	8.5	58.6	

Note 1. In the 1915 experiments Bordeaux and Arsenate of lead was applied while for the dusting a combination of sulphur, hydrated lime and arsenate of lead (50-35-15) was used.

Note 2. In 1916, Lime sulphur and arsenate of lead 1-40 (4 applications) with a fifth application of Bordeaux and arsenate of lead was tested against sulphur and arsenate of lead (80-20.)

Note 3. In 1917, Lime sulphur (1-40) and arsenate of lead was tested against sulphur and arsenate of lead (85-15.)

Note 4. Professor Flint who kindly allow s me to use his unpublished data for 1918 advises me that, due to the late freeze of the fruit in their experimental orchards, no results on dusting for 1919 were obtained. (Letter of Feb. 5, '20.)

Table 4—Results of four years experimental work in Nova Scotia.

		Unsprayed			Sprayed			Dusted			Spray, lime sulphur and ar. lead, or Bordeaux and ar. lead. Dust, sulphur and ar. lead.
Yr.	For No. Exps.	p.c. Scab	p.c. Insects	p.c. Sound	p.c. Scab	p.c. Insects	p.c. Sound	p.c. Scab	p.c. Insects	p.c. Sound	
1916	1	13.9	14.3	71.7	0.2	6.6	93.1	2.0	3.1	94.8	Ann. Rept. Nova Scotia Fr. Growers' Assoc. 1918, p. 61.
1917	2	35.4	4.9	58.9	5.5	2.0	91.0	4.4	1.0	93.7	Ann. Rept. Nova Scotia Fr. Growers' Assoc., 1918, p. 61 and p. 191.
1919	1	90.8	1.2	0.3	21.1	0.2	77.9	11.4	0.0	85.3	Proceedings N. S. Ent. Soc., 1920, p. 88.
1920	1	72.4	7.7	19.9	29.7	7.8	62.5	40.0	9.2	50.8	Unpublished.
Av. of	5	51.4	6.6	41.9	12.4	3.7	83.1	12.4	2.9	83.7	For the four years.

Table 5.—Showing averages of results reported from New York, Michigan, Illinois and Nova Scotia.

Region	No. Yrs.	No. Exps.	Unsprayed p.c. Scab	Unsprayed p.c. Worms	Unsprayed p.c. Sound	Sprayed p.c. Scab	Sprayed p.c. Worms	Sprayed p.c. Sound	Dusted p.c. Scab	Dusted p.c. Worms	Dusted p c Sound
New York . . .	4	11	43.2	22.0	14.3	11.4	7.8	65.9	12.2	5.0	70.0
Michigan	4	7	71.4	12.0	19.7	20.9	0.4	78.4	20.8	0.07	78.8
Illinois	4	7	70.4	44.7	11.8	19.1	8.8	60.1	19.9	8.5	58.6
Nova Scotia . .	4	5	51.4	6.6	41.9	12.4	3.7	83.1	12.4	2.9	83.7
Average of . . .	16	30	56.5	21.4	22.2	15.6	5.2	71.5	15.6	4.0	74.4

studied the question for years, says in the 1920 Fruit Growers' Association of N. S. report p. 82, "A mixture of kaolin and nicotine sulphate dried and pulverized has been used with success in California against the Walnut aphis. We have combined both free nicotine and nicotine sulphate with sulphur and arsenate of lead, thus securing a "3-in-1" mixture, and used with a good effect upon smaller sucking insects such as psyllids. On larger more resistant species, e.g. plant bugs (Miridae), though an apparent reduction was obtained, the results were not entirely satisfactory for the strength tested."

Professor Caesar in the 47th annual report of the Entomological Society of Ontario says; "Finely ground soluble-sulphur mixed with hydrated lime gave me fairly good results on San Jose Scale," though he also says that the mixture was a troublesome one to apply. It is evident that progress has been made, and the thought which is now being expended on this problem by numerous investigators, is sufficient to anticipate a successful solution. To date, however, dust must be considered decidedly inferior to spray in the control of sucking insects.

Comparative Costs.

Not many records seem to have been kept of comparative costs, for so many factors have to be taken into consideration. The capital required for machinery to treat a given acreage, depreciation, gasoline, material, labor, are all factors, some of them difficult to make comparative. The writers have kept strict records over large areas and a detailed discussion of these appears in the 1919 Proceedings of the N. S. Entomological Society, p. 90, 91, 92. During the two seasons of 1919 and 1920 the cost of treating an acre of orchard in Nova Scotia throughout the season has been as follows:

Spray (N.S. Spray Calendar)	\$20 to \$25
90-10 sulphur and lead arsenate dust	\$23 to \$32
Copper-arsenic dust	\$15 to \$20

In Nova Scotia dusting has, for the most part, been cheaper than spraying. The difference in any locality will probably not be great.

Dusters at work in the early morning. Note the slow drift of dust when the air is calm and damp.

Upper end of Experimental Orchard.

Conclusions.

The above article deals with apple orchard conditions. Much experience has been gained within the last few years on dusting potatoes and other field crops, but the time would hardly seem ripe yet for a close analysis of this phase of the subject. But in the orchard it would seem to be possible to make the following fairly definite statements:

1.—Dusting has several definite advantages over spraying.

2.—Dusting is as efficient as spray in the control of scab and of biting insects.

3.—Dusting is as cheap, or can be made as cheap as spraying.

4.—Dusting is inferior to spray in the control of sucking insects.

This last point is often comparatively unimportant. The average Nova Scotia orchard does not require treatment for sucking insects on an average more than once in five years, and as long as sufficient spray outfits are in the district for this purpose, all other treatments may be left to the dust. Doubtless many districts are similarly situated.

(The second article in this series will appear in an early issue.)

Canadian Branch of the American Phytopathological Society

Second Annual Meeting.

This meeting was held in the Biological building of the Ontario Agricultural College at Guelph, Ontario, on December 9th and 10th, 1920. There were present about forty members including Dr. Buller of Manitoba University, Dr. Faull, of Toronto University, Dr. MacClement and Dr. Reid, of Queen's University, Prof. Fraser, of Saskatoon, Prof. Dickson, of Macdonald College, Dr. Rankin, of St. Catherines. Prof. Howitt and Dr. Stone, of the O.A.C., F. L. Drayton and A. W. MacCallum, of Ottawa, and many others. The guest of honour was Dr. Donald Reddick of Cornell University, a leader in plant pathology, one of the founders of the official organ Phytopathology and also of Botanical Abstracts.

Dr. Buller occupied the presidential chair and delivered an excellent address in which he pointed out the almost incredible losses incurred annually by agriculture because of plant diseases and the lamentable lack of experts. This condition was shown to be exceedingly serious especially when compared with present progress in the United States of America, Great Britain, France, Japan, India, Australia and South Africa.

During the business meeting the committee appointed to wait on the Honorable Minister of Agriculture relative to the appointment of a Dominion Botanist who could command the confidence of both pathologists and agriculturists, reported that the matter was under consideration and that action was promised. In view of the fact that so far no action has been taken and that since the last meeting still another expert pathologist has been lost to Canada, it was unanimously decided to retain the committee for further action during the coming year. This was rendered all the more imperative since the work so excellently carried on by Professor Fraser, at Saskatoon, is in danger of being brought to an end owing to lack of help. This would be the greatest blow possible to any attempt to control rusts of cereals in Canada.

Dr. Donald Reddick in a public evening address gave a lucid and interesting account of the trend in plant pathology, and among many important features pointed out that the great advances in our knowledge of this science came from the years of careful painstaking work which did not directly appeal to the layman. But the results of such scientific endeavor can be made obvious to the layman if the proper facilities were available.

Brief mention is here made of the papers given applying directly to plant diseases.

Professor Dickson showed that in addition to tobacco, tomato, potato, clovers, etc., suffering from mosaic, raspberry likewise suffers from this most widespread disease. In the past mosaic of raspberry had been confused with "yellows or curl." A description was also given of mosaic on Vicia faba.

The biologic strains of stem rust of wheat, as studied by Fraser, Bailey and Miss Newton, in the West were explained by Professor Fraser, the difficulty and importance of which work needed no emphasizing.

Dr. Stone reported a new disease of strawberry, prevalent on Clyde and Glen Mary, in Ontario, caused by Mollisia earliana (E & E) Sacc. Trials conducted so far tended to show that it could be controlled by destroying old leaves in the autumn. Senator Dunlap is resistant to this disease up to the present.

That the dry formaldehyde treatment of oats for smut (one pint formalin to one pint water) is the most efficacious and the most easy to handle was clearly shown by Professor Howitt's experiments covering a period of three years. There is no appreciable injury to germination and the seed does not swell as a result of treatment.

Work on the plant disease survey during 1920 was reported by Dr. Rankin and further developments planned for 1921. This is a very important phase of plant pathology, for it is only by a careful survey, that serious plant diseases are located regionally. Dr. Rankins and Professor Fraser's work in this respect was accorded the hearty approbation of the Society.

Dr. Faull discussed very clearly the timber rot caused by Fomes fomentarius which is prevalent in Ontario forests.

Characteristically interesting papers were read by Dr. Buller, supplemented by excellent lantern slides and Mr. Duff gave an account of his studies on the Geoglossaceae.

Professor Caeser urged the importance of extension work in the control of plant diseases.

The officers for the ensuing year are as follows:

President—J. H. Faull.
Vice-President—H. Rankin,
Secretary-Treasurer—R. E. Stone,
Councillors—A. H. R. Buller, B. T. Dickson.

Inter-Relations in Nature

By Prof. W. LOCHHEAD, Macdonald College.
(Paper read before the Ontario Entomological Society, Guelph, November, 1920).

To the economic entomologist the investigation of the "Inter-relations in Nature" should be one of the most important fields of study, for abundant evidence has been collected to show that all nature is a vast system of linkages, one part dependent upon another in an intricate web of life, and that disturbances in one portion of the system are followed by disturbances in another. To Darwin more than any other person science is indebted for the elaboration of the idea and for the clear demonstration of its practical importance.

Since Darwin's time the number of examples of inter-relations has been greatly extended through the observations of thousands of investigators. In our boyhood days we were accustomed to rhyme the chain of events in the House that Jack Built which ends with "This is the cat that killed the rat that ate the malt that lay in the house that Jack built." In Nature many such chains have been unravelled binding animal with animal and animals with plants and these again with the inorganic world. Man eats the fishes that eat crustacea that eat infusoria that eat bacteria that feed on decaying organic matter in some pond.

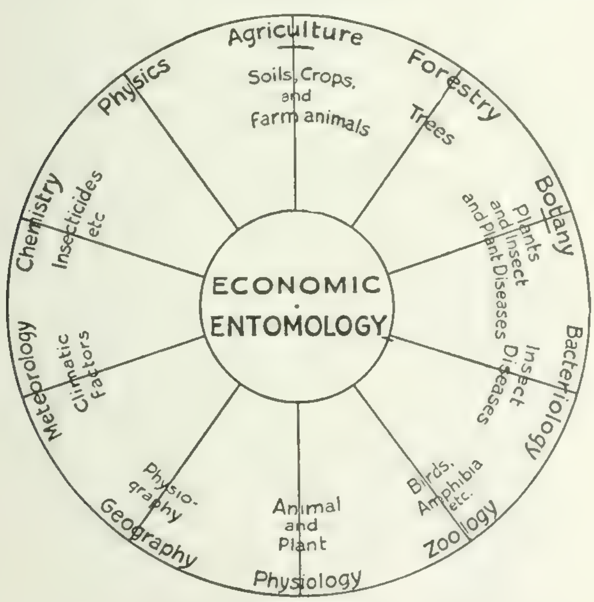


Diagram showing the sciences bearing most directly upon Economic Entomology.

The purpose of this paper is to discuss briefly, or rather to point out, those inter-relations in nature that have to do more particularly with insect life. The subject is a big one, so that much more must necessarily be left unsaid than can possibly be said in a paper on this occasion.

The following relationships will be discussed:—

1. Insects in relation to insects;
2. Insects in relation to other animals;
3. Insects in relation to plants, including bacteria and fungi;
4. Insects in relation to inorganic nature.

1. Insects in Relation to Insects.

The part played by predatory and parasitic insects in the regulation of insect life has been frequently discussed at these meetings. The topic is a very important one and studies are being carried on at many stations and none better than those by Mr. Tothill of the Dominion Entomological Laboratory at Fredericton, on the factors operating on the Forest Caterpillar and the Fall Web Worm.

The elaborate studies of the parasites of the Gypsy Moth in New England and their part in the control of the pest have been summarized by H. S. Smith in the Journal of Economic Entomology, August 1919, as follows:—

1.—The reproductive capacity of available entomophagous insects must be much higher than that of the host. This proposition is self-evident, and needs no amplification.

2.—A complete sequence of parasites affecting the egg, larva and pupa of the pest. The importance of this factor was fully shown in the campaign against the Gypsy moth.

3.—The entomophagous forms must be capable of being reared or obtained in sufficient quantities to overcome the pest in the field. This factor is one of the most difficult to bring into operation. Lady-birds are readily reared and collected.

4.—The cost of producing natural enemies must remain well within the bounds of profitable crop production.

5.—Secondary parasites in the local fauna should limit as little as possible, much less entirely prevent, the action of the primary parasites. This factor is also one that is most difficult to control.

6.—Agricultural practices such as spraying and fumigation which affect adversely the breeding of natural enemies should be prevented. It is probable that the extermination of the imported Chinese Lady-bird in southern orchards was due mainly to spraying operations with lime sulphur carried on as a practice.

7.—The relative ability of the pest and its enemies to spread is an important factor. If both be good fliers the power of spreading is increased but the likelihood of extermination of the pest is lessened.

The citrus mealy-bug has been controlled in Southern California by the Australian lady-bird *Cryptolaemus montrouzieri* which was reared in large numbers at the State Insectary and collected in orchards where they had become abundant late in the season. In this instance, as in that of the cottony-cushion scale, the lady-bird is an active insect while the scale insect is fixed to the plant. Moreover, the lady-bird has more generations than the scale insect and is practically free from parasites.

Dr. P. Marchal calls the Gypsy and brown-tail experiments in America "a gigantic biological analysis and synthesis bearing upon all the elements which constitute the harmonic groupings of plant-feeding insects, their predators, parasites and hypiparasites, the taking apart piece by piece of the whole system, and its partial reconstruction in a new environment, forcing it to give the greatest possible stress to the elements most favorable to man and reducing to the minimum those which oppose their action".

2. Insects in Relation to Other Animals.

Nature has evolved not as independent but often as closely dependent organisms. The well-being of one set is frequently related in many ways to other sets, and no creature can be said to live unto itself. Insects and plants, for example, have been for long ages mutually adapting themselves one to the other, the plant to the insect and the insect to the plant. We all know how birds keep down insects and many rodents; in fact, an approximate equilibrium has been established between them. Any disturbance or sudden reduction in the numbers of the birds of a region is sure to disturb the equilibrium or balance in the insect world and cause much loss to the crops upon which the insects feed.

Moreover, the number of carnivorous animals bears a definite proportion to the herbivorous animals upon which they feed, the herbivorous animals to the plants, the plants to insect visitors, etc. In this web of Nature we may note that the animals preyed upon are more

A. B. C.
A.—**Phiromalus puparium**, a chalcid parasite of chrysalids of the cabbage caterpillar.
B.—**Pimpla conquisitor** depositing on cocoon of tent caterpillar (after Fiske).
C.—A parasitic tachina-fly and its puparium (after Weed).

prolific than the predaceous forms. "Small rodents tend to be much more prolific than carnivores. The primary reason for this is probably that less individualed types tend to be more prolific."—(Thomson).

Sometimes man interferes with the balance of Nature and serious consequences follow. Rats became a great plague in Jamaica and to offset them the mongoose, a weasel-like animal, was introduced. The mongoose made short work of the rats, but it turned its attention to useful animals such as poultry, ground-birds and insect-eating lizards and snakes. As a result injurious insects and ticks have increased greatly, and both plants and animals have suffered much injury.

Facts which convince even the most sceptical are accumulating regarding the valuable role played by birds in the control of noxious insects. Studies of bird diets prove conclusively that the majority of our common birds feed mainly upon insects. Forbes of Illinois states after a careful study of the contents of the stomachs of birds that about two-thirds of the food of birds consists of insects. Well-informed writers tell us that without birds the earth would be uninhabitable after six years, and yet man in his ignorance is constantly destroying these valuable friends, simply because he finds that they levy an insignificant toll on his fruits and grains. It is possible that we would be better off if certain birds were greatly reduced in numbers, but of this we are not absolutely certain, for the web of life is most complex, and no person knows how far-reaching the results would be.

Aside from the fact that birds aid very materially in reducing the numbers of insects when they come as scourges, it is very important to remember that birds nip many incipient scourges in the bud. Their mobility and varied character and habits enable them to move rapidly from place to place and thus maintain the balance of nature which man is always tending to upset. Even in wild nature the balance is never quite complete; at best the equilibrium is unstable.

"It is very interesting that the two great classes of successful fliers should be in the wide economics of Nature fitted against one another, wings against wings, freeman against freeman, invertebrate against invertebrate, "little brain" against "big brain", "instinct" against "intelligence". Practically this is the most important conflict of classes that the world knows." —(Thomson).

It is worthy of note that the Italian entomologists do not share the opinion of American and British fellow workers as to the great value of birds in the control of insect life.

From 1850 to 1873, Rondani, an Italian, made most valuable contributions to the study of parasitology. He was of the opinion, however, that parasites were far more important than birds as control factors. He said: "The policing of the fields cannot be entrusted to birds because they are unreliable and kill the guilty with the innocent; they are robbers as well as guardians of the field products, and therefore do not yield the most, and sometimes any calculable advantage. In the latter case they often do even more harm than good in the very things which were sought to be saved by their means."

Perris and Decaux of France in the seventies and eighties advocated strongly the use of parasites, and Berlese and Del Guercio of Italy later recognized and emphasized the value of entomophagous insects rather than insectivorous birds.

In this connection it is interesting to note Silvestri's own opinion. He says: "I, for my part, believe that

Syrphus flies: 1 and 2, adults; 3, larvae eating plant lice; lower figure contracted larva; 5 and 6, view of larva, enlarged, and pupa.

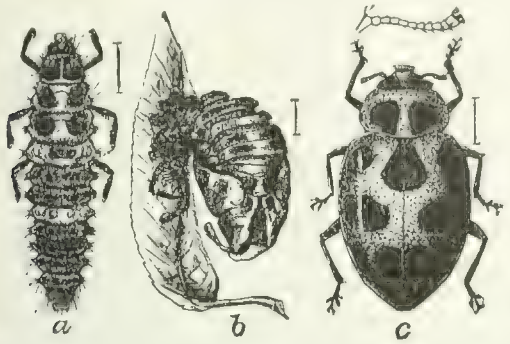
the usefulness and the harm of insectivorous birds balance each other and that more frequently the former may be superior to the latter, considering things only from the viewpoint of immediate agricultural interest".

Insects and Animal Diseases.

The relation of insects to active diseases is now well known. The Anopheles mosquito the yellow-fever organism, the Stegomyia mosquito the yellow-fever organism; the house-fly tubercular, typhoid fever and other germs; the stable-fly infantile paralysis; tsetse flies the trypanosomes of the terrible "sleeping sick-

ness'' of Central Africa; rat-fleas plague germs; lice typhus fever germs; etc. There is no longer any doubt as to the inter-relationships that exist in this part of the web of life.

Again, fishes furnish another link in the chain connecting mosquitoes and malaria. As is well known certain fishes feed upon mosquito larvae, and in many districts are undoubtedly instrumental in regulating the amount of malaria. It is believed that the presence of the small fish called "millions" in Barbados is the reason why that island is so free from malaria.



Lady beetles ("lady birds," "lady bugs,") or coccinellids: a, larva; b, pupa; c, imago; all much enlarged. (U.S. Bu. Ent.)

Rabbits are not only a direct cause of great losses to the Australian farmers but also indirectly in developing the blow-fly pest which is very destructive.

3.—Insects and Plants.

We are familiar with the enormous losses produced every year by the action of insects and fungous diseases on our cultivated crops. But we should not fail to look at the other side of the shield, and ascertain how many plants are dependent upon insects for their fertilisation and the production of seed.

Elsewhere (in the Third and Fourth Reports of the Quebec Society for the Protection of Plants) I have discussed the relations between insects and plants, and their value as pollinators of useful plants. In this connection I may quote Dr. Phillips' remarks regarding the value of the honey-bee: "The production of millions of dollars worth of fruit depends largely on insect pollination, and no insect is so important in this work as the honey-bee. It is a most conservative estimate to claim that the honey-bee does more good to American agriculture in its office as a cross-pollinator than it does as a honey gatherer."

In the relation of Insects to Plant diseases, two aspects present themselves, viz. (1) the role of insects as disease-carriers to plants, and (2) the role of fungous diseases in destroying insects.

It is clear that if these relations are to be thoroughly investigated, the economic entomologist must work in close co-operation with the plant-pathologist.

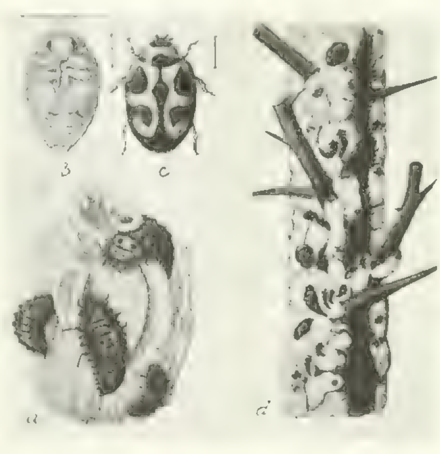
With regard to the part played by insects as disease-carriers to plants, I cannot do better than refer you to the excellent paper by Prof. Caesar read at the last meeting here (1918 Report Ont. Ent. Soc.) and to the article by Mr. E. M. DuPorte in the 11th Report of the Quebec Society for the Protection of Plants, (1918-19) where the subject is fully discussed.

An interesting relation is the double-host relation of many aphids. Nearly every year adds to the number of aphids that have this relation, and future studies will perhaps furnish an explanation of this interesting movement in early and late summer to the host plants. The relation is of interest to the economic worker as it suggests additional means of control.

Another inter-relation somewhat closely related to the foregoing is that of useless plants and insects. One instance will suffice. The hawthorns act as hosts for many insects that are injurious to the apple. It is clear that the relationship demands more careful study by economic entomologists.

With regard to the utilization of fungous and protozoan diseases in insect control (1), it may be said that many experiments have been conducted within the last thirty years with the object of controlling injurious insects through the artificial production of epidemics of fungous diseases. As in the case of parasitism unexpected difficulties have appeared under field conditions. It was soon discovered that "fungi are very dependent upon external conditions, and in many cases the apparent absence of a particular fungus in a locality is usually an index of conditions unfavorable for its development and an artificial introduction will be useless" (Glaser).

Out of the large number of experiments that have been carried out, I shall briefly refer to a few of the most outstanding ones. Franz Tangl in 1892 used spore emulsions of "*Botrytis bassiana*" against the caterpillars of the nun moth of Central Europe. While the experiments were eminently successful in the laboratory where all the infected caterpillars died of "muscardine", those carried on outdoors gave negative results. Tubeuf also obtained like results with "Cordyceps militaris."


Australian lady-bird beetle **(novius cardinalis)**, the enemy of the white scale (natural size). a, lady-bird larvae feeding on adult female and egg sac; b, pupa; c, adult lady-bird; d, orange twig, showing scales and lady-birds (after Harlatt, U. S. Dept. Agr.).

Many of us perhaps are familiar with the work of Snow and Forbes in connection with the artificial use of "Sporotrichum globuliferum" against chinch bugs. Later Billings and Glenn also carried on experiments

(1) European botanists, such as DeBary and Tulasne, about the middle of the last century called attention to the importance of white muscardine (*Isaria densa* Link.) as a check on many insects. Metchnikoff, and Krassilstscik cultivated the green muscardine (*Metarhizium anisopliae Sorokin*) for the control of *Anisoplia* and the beet weevil (*Cleonus punctiventris*).

Efforts have also been made to check the white grub in Europe by means of Cordyceps melolonthae Tul., *Isaria densa* and *Botryllis tenella* Sacc.

with the same fungus. Their results are summarized as follows:

1.—"In fields where the natural presence of the fungus is plainly evident, its effect on the bugs cannot be accelerated to any appreciable degree by the artificial introduction of spores.

2.—"In fields where the fungus is not in evidence spores introduced artificially have no measurable effect.

3.—"Apparent absence of the fungus among chinch bugs in a field is evidence of unfavorable conditions rather than lack of fungous spores.

4.—"Laboratory experiments can be made to prove that artificial infection accomplishes results upon bugs confined in cramped quarters and without food, but in the field, where fresh and usually drier air prevails and food is abundant, an entirely different situation is presented."

In 1912 Morrill and Back experimented with the artificial use of the white fly fungi. *"Aegerita webberi." "Aschersonia aleyrodis"* and *"A Chyocinta."* They summarized their conclusions in these words:

1.—"The fungus parasites thrive only under suitable weather conditions during a period of about three months each year; generally speaking the summer months in the case of the two Aschersonias and the fall months in the case of the brown fungus.

2.—"Under natural conditions, without artificial assistance in spreading, the fungi have ordinarily, in favored localities, controlled the white fly to the extent of about one-third of a complete remedy through a series of years.

3.—"The infections secured by artificial means of introducing fungi, while successful in introducing the fungi, have thus far proved of little or no avail in increasing their efficacy after they have once become generally established in a grove.

4.—"Experiments by the authors, and by citrus growers in co-operation with the authors, involving the treatment of thousands of trees with suitable "checks" or "controls" have shown that when fungus (red or yellow Aschersonia) even in small quantities is present in a grove, there is no certainty that from three to six applications of fungus spores in water solution will result in an increased abundance of the infection on the treated blocks of trees by the end of the season. In some of the most important and carefully planned and executed experiments, the fungus has increased more rapidly in sections of the groves which were not sprayed with spore solutions than in the experimental blocks."

The Brown-tail caterpillar is attacked by the fungus Entomophthora aulicae, and an attempt was made by Speare and Colley in 1912 to use it in the control of the pest. They state that considerable success has attended their efforts, not that the fungus is a "cure-all" but it is a powerful check. Under proper conditions of introduction from 63 to 100 percent of the caterpillars can be destroyed.

Reference has already been made to the "Wilt disease" of Gypsy-moth caterpillars as a factor in the control of these pests in New England. It made its appearance about 1900 and is now distributed over the territory infested with the Gypsy-moth, according to Glaser. It is an infectious disease but epidemics occur only in localities infested heavily with the Gypsy-moth. Infected caterpillars become flaccid and later their tissues disintegrate completely, due to the fermentative and toxic nature of the virus. The brown liquid of a dead caterpillar shows under the high power of the microscope large numbers of polyhedral bodies of various sizes, but the exact nature of the causal organism has not been determined. The virus is filterable with difficulty.

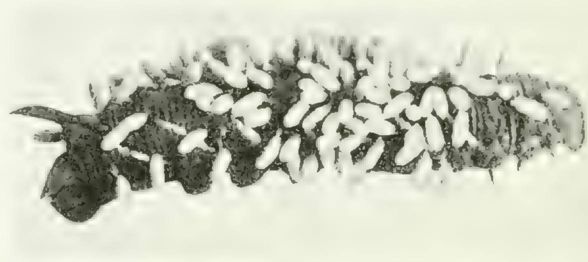
The success of wilt infection experiments is absolutely dependent upon attention to seemingly insignifidetails, but this much is known that infection takes place through the mouth by means of the food.

It is probable that further studies of the disease will evolve some practical method of using the virus for the destruction of larger numbers of the caterpillars. Already, however, it has been ascertained that climatic conditions appear to bear an important relation to wilt in the field, and that temperature has an important relation to the period of incubation of wilt.

4.—The Relation of Insects to Inorganic Nature.

This relation has also been investigated by many workers for it has long been known that insects are influenced profoundly by climatic conditions. The effects of changing and unusual conditions of heat and cold, snows and rains, humidity and dryness, and other seasonal changes have long been known to be important factors in regulating the number of insects.

A variable winter is more fatal to most forms of insect life than a continuously severe or a continuously mild winter. When insects go into hibernation they become torpid and are able to resist quite low degrees of cold, but if thaws occur they may become partially active for a short time. With every change of this nature the insect loses vitality and this loss may prevent transformation in the spring. Moreover, the effects of thaws in breaking up larval and pupals cells in the ground are often quite marked.



Sphinx Caterpillar with cocoons of braconid parasites.

Sudden changes of temperature of say 30 deg. range within a few hours, which are quite common in our latitude, are very fatal to aphids and many caterpillars during their early stages.

Another feature of the environment of insects is the different degree of humidity demanded by each species or genus. Some insects like the thrips, chinch bug, wheat midge and red spiders are more abundant under dry conditions, while other insects like the plant lice and Hessian-fly develop best under moist conditions.

Observations seem to show that meteorological changes are often fatal to those insects that live on the fringe of their distributional range. Under favorable conditions some insects may migrate northward and even do much damage, but such movements may be termed *incursions* as they are temporary and spasmodic in their character.

The range of distribution of different insects has been mapped, and this has shown that insects tend to conform to the same zonal distribution as plants,

birds and mammals. Dr. Hopkins, of Washington, has extended our knowledge of the Bioclimatic Law and has shown how it may be utilized by the economic entomologist in solving some of his problems. (See Article in 1919 Report of Ont. Ent. Soc.).

The recent study of tropisms appears to show that the movements and conduct of insects are often the result of stimuli proceeding from the inorganic world, such as *light, gravitation, heat, electricity, moisture, pressure,* and *chemical substances.* Already many interesting observations have been made and a few of these have an economic bearing.

It seems to me that this field of study, viz.: the reactions of insects to stimuli, is full of great possibilities for the economic entomologist. In the future, when our knowledge of tropistic responses has greatly increased, we may expect to see the introduction of many modifications of our present methods of control.

He who studies attentively any common plant or animal may form a conception, often an imperfect one, of the widely extending lines and cross lines of inter-relationship with other plants and animals. The work of science is to classify and describe these inter-relations, and in this line much progress has been made since Darwin's day. The economic entomologist and botanist, who are specially interested in the control of injurious insects and plants, must keep constantly in view this idea of relationships in Nature if they would deal successfully with the problems confronting them.

At the recent meeting of the American Association of Economic Entomologists at Philadelphia many prominent leaders emphasized the necessity for a more thorough biological study of all injurious forms. In other words, more attention should be given to oecologic or bionomic relations; that is, to the study of the Web of Life.

A knowledge of inter-relations, even in departments not usually considered in close alliance, is often essential in unravelling the intricate pattern of life's web.

"Over a ploughed field in the summer morning we see the spider-webs in thousands, glistening with dew-drops, and this is an emblem of the intricacy of the threads in the web of life—to be seen more and more as our eyes grow clear. Or, is not the face of Nature like the surface of a gentle stream, where hundreds of dimpling circles touch and influence one another in an intricate complexity of action and reaction beyond the ken of the wisest?—(Thomson).

Grasshopper Situation in the Prairie Provinces

Synopsis of Talk Given by Mr. Arthur Gibson, Dominion Entomologist, Before the Eastern Ontario Branch of the Canadian Society of Technical Agriculturists, December 11, 1920.

Mr. Gibson in his opening remarks referred in general to grasshopper control which had been conducted in the United States and Canada, mentioning particularly that poisoned baits had proved most effective. He mentioned that as far back as 1885 a mixture of bran and arsenic with sugar had been used in California, particularly under orchard and vineyard conditions. In Canada, such a mixture was used with success at Ottawa, in 1888, by the late Dr. Fletcher, Entomologist and Botanist of the Dominion Experimental Farms. The first record, however, under acre conditions doubtless refers to work conducted in Manitoba in 1901, when under the direction of Mr. Norman Criddle extensive areas were treated with remarkable success.

In 1913 as a result of serious infestations in the State of Kansas a similar mixture was used with the addition of lemons and oranges. The addition of these fruits had proved attractive to the grasshoppers and they were killed in enormous numbers.

During the years 1914-15 the Entomological Branch conducted numerous experiments in Eastern Ontario and portions of Quebec Province and had an excellent opportunity of testing the value of the Kansas formula, and also new poisoned baits devised by our own officers. In the latter year particularly, experiments conducted with formulae in which sawdust was used largely, as a substitute for bran gave most promising results, as also did formulae containing salt as an attractant instead of molasses, lemons and oranges. In that year applications in which bran had been used as the carrier for the poison cost twenty-seven cents per acre whereas with mixtures in which sawdust alone was used as a carrier for the poison, the cost was reduced to seven cents per acre.

In 1915, working in co-operation with the parish priests of the Province of Quebec, 33,000 acres of growing crop were treated with remarkable success. Previous to this year the grasshoppers had caused extensive damages in these parishes resulting in the abandoning of many farms.

Speaking of the outbreaks in the Prairie Provinces during the last two years it was stated that the one in Manitoba developed rather suddenly and no active organization was prepared to meet the emergency. However, our federal officers, particularly Mr. Norman Criddle in Manitoba, and Dr. A. E. Cameron in Saskatchewan, at once got into close touch with provincial officers and, acting in close harmony, farmers were advised promptly as to the means of control and large sections of infested land were saved by the prompt application of poisoned bait.

In working with such an insect as the grasshopper prompt community action is essential for success. From observations made in the fall of 1919 by our federal officers stationed in the Prairie Provinces, large numbers of eggs were found to have been laid by destructive species of locusts and there was, therefore, every prospect of a serious outbreak in 1920. This unfortunately was realized, but owing to a definite plan of organization which had been arranged by the Provinces of Manitoba and Saskatchewan, Federal and Provincial officials were at once able to cope with the situation as soon as grasshoppers hatched in enormous numbers last May and June.

In Manitoba, Mr. Criddle visited practically every section of the Province which was infested; he addressed a large number of meetings, frequently in company with Mr. A. V. Mitchener of the Manitoba Agricultural College and gave expert advice as to the mixing of the poisoned bait at mixing stations established through-

out the province. Altogether Mr. Criddle travelled over 4,000 miles by motor.

During the height of the infestation, from 12 to 14 tons of poisoned bait were mixed at some of these mixing stations. On one occasion at Deloraine as much as 18 tons were mixed and those in charge of this station worked day and night. As a result of the close co-operation between federal and provincial officials excellent results attended the campaign of 1920. The provincial officials have been able to secure definite information as to the actual value of this campaign and their figures show that the enormous amount of $17,000,000 was actually saved by the farmers in adopting federal and provincial recommendations.

As an instance of the value of poisoned bait, Mr. Gibson mentioned that on one occasion 440 dead locusts were found to a square foot. This indicates that the insects were present in the district to the extent of 19,166,400 to the acre. The Manitoba Government supplied the bait to the farmers free of charge and the cost to the Province in this respect was $155,000.

The speaker emphasized the importance of the discovery made by the officers of the Entomological Branch, namely the value of sawdust as a carrier for the poison and also of salt as an attractant to the grasshopper. As a result of these discoveries many thousands of dollars have been saved to the province in 1920.

The organization in Saskatchewan was of a somewhat different nature and was more of a semi-military character. The provincial officers worked in close cooperation with the municipalities. In general the provincial officers directed the campaign and the municipal officials actually carried out the instructions. It is interesting to note that the following ingredients were purchased by the province of Saskatchewan at a cost of over $300,000—2,720 tons of bran, 225 tons of sawdust, 12,636 gallons of molasses, 2,805 cases of lemons, 166 tons of white arsenic, and 34 tons of Paris Green. As a result of the work in Saskatchewan the provincial officials have estimated that no less than 1,400,000 acres of crop have been actually saved by the applications of poisoned bait. In the whole of this work the value of white arsenic was amply demonstrated. This insecticide certainly reduced the cost of the applications.

In Alberta, Mr. Strickland of the Entomological Branch devoted much time to visiting farmers, addressing meetings, etc. The provincial government undertook to distribute the ingredients for the poisoned bait at cost to such organizations which could handle the same in bulk. Messrs. B. Lawton and P. Tompkins, provincial officials, assisted Mr. Strickland in his work.

Mr. Gibson also outlined briefly some work which the federal department had conducted in Saskatchewan in connection with testing out new remedies for grasshoppers, which consisted chiefly of the application of dusts to infested areas, the spraying of contact insecticides, the application of poisoned gases and the testing of new poisoned baits. These experiments were under the immediate direction of Mr. A. Kelsall of the Entomological Branch. Speaking particularly of Mr. Kelsall's work with poison gases reference was made to experiments conducted with chlorine gas, which certainly indicated that the insects could be destroyed by such a method, but on the whole this was too expensive for practical use.

With reference to a continuation of the grasshopper outbreak in the Prairie Provinces, Mr. Gibson mentioned that officers of the Entomological Branch had investigated many areas in the three Prairie Provinces and there was indeed evidence that large numbers of eggs had been laid by grasshoppers during the months of August and September. In one place he stated that as many as 3,000 eggs had been found to a square foot.

Reference was made also to the recent International Conference held at Winnipeg which was called purposely to discuss the grasshopper situation. One result of this conference was the appointment of a special committee who will meet and correspond before the spring of 1921, so that definite cooperative plans will be decided upon and the same means of control recommended. This committee consists of Mr. Norman Criddle, Chairman, Mr. M. P. Tullis, Representative for Saskatchewan, Mr. A. V. Mitchener, Representative for Manitoba and Mr. S. Lockwood, Representative for North Dakota.

WORK OF THE DOMINION CEREAL DIVISION.

At the meeting of the Ottawa branch of the C. S. T. A. on the evening of December 11th, Dr. C. E. Saunders, Dominion Cerealist, gave an address in which he reviewed the work of the Cereal Division from the inception of the Experimental Farm system to the present time. He pointed out that the objects of the division are twofold, namely, first, to study from the point of view of pure science such problems as arise in reference to the breeding of cereals and the storage and utilization of cereal products, and second, to carry on researches in applied science to ascertain what are the best varieties and types of cereals for all parts of Canada, and to produce by cross-breeding and selection new and special sorts whenever the best varieties now in existence are unsatisfactory.

Among the problems of a purely scientific nature which have been studied, there may be mentioned (1) The occurrence of natural crosses in wheat; (2) The inheritance of awns in wheat, and of hoods in barley; (3) The inheritance of baking strength in wheat.

Some of the most important practical results include (1) The propagation of the best, old, standard sorts in pure condition, and supplying the seed to farmers; (2) The importation of new varieties from abroad; (3) The production of new sorts by cross-breeding and selection; (4) Studies of the effects of storage, dampness, artificial bleaching, etc., of wheat and flour.

Some of the most important new varieties thus far introduced were mentioned. These include Huron wheat, Arthur and Mackay peas which were originated by the late Dr. William Saunders, Marquis and Early Red Fife wheats and Longstem flax, originated by the present Dominion Cerealist by selection, and Prelude and Ruby wheats, and Liberty (Hulless) oats, originated by the same person by cross-breeding followed by selection.

The present condition of the Cereal Division was touched upon, and some of the problems of the immediate future were referred to. The fact was emphasized that the Cereal Division would be capable of going ahead very much more rapidly, and accomplishing a great deal more for the country if it were adequately supported by the Government. Among the most promising new experiments now being undertaken mention was made of the propagating and testing of about thirty new cross-bred varieties of flax for fibre purposes.

Breeding Methods in Forage Plants

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(Read before the Western Canadian Society of Agronomy, and published through the courtesy of that Society

Note.—On account of being prepared for presentation at the meeting of The Western Canadian Society of Agronomy, held at Edmonton, Alta., December 28-30, 1920, the present paper is restricted to deal with breeding methods of a practical nature applicable to Forage Plants of particular interest to Western Canada. It does not deal with breeding methods applied to Field Roots, as these are of little importance to the West. Neither does it deal with breeding methods applied to Indian corn. It is confined to breeding methods applicable to Grasses, Alfalfa and Red Clover.

Importance of Satisfactory Breeding Material.

Concerning the breeding of Grasses, Alfalfa, and Red Clover in Canada, it should be emphasized that the results of the breeder's efforts will in a large measure depend upon the general nature of the material with which the breeding work is to be undertaken. Of particular importance is the necessity of working with perfectly winter-hardy material. If this is not done, the breeder may experience some disagreeable disappointment sooner or later.

As an example may be related an incident in Orchard Grass breeding at the Central Experimental Farm, Ottawa. Years ago, some partially fixed strains of Orchard Grass representing apparently very high-yielding types were received from Europe. The strains in question were grown for observation a couple of years and, as they appeared to stand the Ottawa climate without suffering any winter-killing whatever, it was decided to perfect their uniformity. Accordingly, breeding work was started and, in the summer of 1918, seed was harvested from several distinct varieties breeding almost true to type and looking very promising from a hay-producing standpoint. The seed was sown in 1919 and of each variety a number of individual young plants were set out for the purpose of finally testing the uniformity of the varieties. The winter of 1919-20, however, happened to be very unfavorable to grasses and clovers and in the spring of 1920 it was found that every plant of the different varieties was killed. It may be claimed that the killing might have been due to a general weakening on account of repeated inbreeding but, on the other hand, it was also found that a number of the original Orchard grass plants which for years had proven perfectly cold-resistant were also killed. This invites the conclusion that the material worked with was hardy under ordinary winter conditions but not sufficiently, at least only partly so, under very trying conditions.

This experience at Ottawa is related to show how very important it is to start from material that is perfectly winter-hardy. This is especially the case when working with species which are recognized as being more or less tender, such as Orchard grass, Tall Oat grass, Red Clover, Alfalfa and others. In the case of Orchard grass referred to, it took seven years before its lack of perfect winter-resistance was brought out. It is evident, however, that it is impracticable to spend such a long time on observations before starting breeding work proper. In order to start breeding work with a tender species as soon as possible, it would therefore be opportune to take some short cuts whenever possible, i.e., to secure hardy material without having to spend many years on observations. This can rather easily be done.

All the grasses and clovers grown in Canada for hay and pasture occur either in the wild state or as escapes from cultivation. The wild plants and the escapes live generally under conditions which are much more trying than those under which the cultivated plants exist and it is therefore only reasonable to surmise that they may represent comparatively hardy

Figure 1.—Western Rye Grass forms, breeding true to type without isolation of the mother plants. Each row grown from seed of an individual plant.

Figure 2.—Western Rye Grass; comparatively poor varieties.

types. This is especially the case with escapes occuring in colonies. If colonies living under "wild" conditions are found for instance of Red Clover in Manitoba, if colonies of Orchard grass are found at Edmonton, then one may be justified in concluding that the colonies in question are likely to represent types that are perfectly hardy for the localities in which they are found, the size of the colonies serving as an indication of the number of years in which they have persisted. It is from such colonies that the most hardy breeding material of tender species may be secured.

Methods of Breeding.

Granting that a breeding material, satisfactory in respect to hardiness, has been secured, the breeder's efforts will be directed toward the fixing of agriculturally valuable types found in the material available, in other words towards development of superior and constant varieties. The methods which may be employed to achieve this object depend primarily on the type of sexual reproduction characteristic to the species worked with. And as there exist great differences in the manner in which different grasses and leguminous forage plants are sexually reproduced, different methods are resorted to accordingly. In the following, four types of sexual reproduction found in grasses and clovers will be mriefly dealt with and the breeding methods applicable to each case indicated.

1. Wind-pollinated grasses.—The most common type of pollination in grasses is, as is well known, wind pollination , i. e., the transportation of pollen from the stamens to the pistils by means of air currents. In this type of pollination the pistil of a flower may be fertilized by pollen from the same flower, by pollen from other flowers of the same plant, or by pollen from other plants. Cross-fertilization may consequently take place and so it does to a great extent for, if seed from a wind-pollinated plant growing in company with other plants of the same species is sown, the progeny proves as a rule to be very heterogenous. In order to develop uniform varieties, breeding true to type, from such a heterogenous mass of forms, it is necessary to resort to repeated inbreeding, *i.e.*, to self-fertilize individual plants of desired type for consecutive years until constancy has been reached.

It is obvious that the self-fertilization operations must be carried on under the best possible guarantees. In other words, the breeder must protect the self-fertilized-to-be plants from being pollinated by other plants. With this object in view several isolation methods are being employed. The oldest method, perhaps, consists of enclosing individual heads, or a few heads together, in paper bags, often oiled so as to allow light to penetrate. This method of course makes it possible to guarantee a perfect exclusion of foreign pollen but it has several drawbacks, the worst one being that the formation of seed of strong vitality is suffering a serious set back. When paper bags are used, the isolation is perfect and for this very reason there is no chance for the moisture produced by the heads through physiological processes to escape. The result is that the atmosphere inside the isolation bags becomes overcharged with humidity, especially as it is often necessary to keep the heads isolated for a week or more. In the atmosphere loaded with humidity the formation of seed is seriously hampered, perhaps not so much because the excess of moisture prevents the fertilized pistil from developing normally but rather because grass pollen in general is very sensitive to humidity, refusing entirely, as a matter of fact, to germinate under very humid atmospheric conditions.

As it is essential, in order to test satisfactorily the constancy of a type, to secure hundreds of germinable seeds from each individual plant worked with, the method of enclosing a whole plant in cages of cheese cloth or similar material is commonly employed. With this method it is easy to obtain large quantities of good seed, largely because the atmospheric conditions inside the isolation cages are more normal. But the method has also its drawbacks, in as much as it does not guarantee, as fully as it should, the exclusion of pollen from outside the cages. Even if the cages are built of double cheese cloth, which is generally the case, there is no absolute guarantee against foreign pollen blowing through the meshes of the cheese cloth.

Considering the necessity for as normal atmospheric conditions as possible in the cages, and considering also the necessity of protecting, as much as possible, the isolated plants from pollination from the outside, a sort of combination cage was used last year in the timothy breeding block at the Central Experimental Farm at Ottawa. This cage was made very roomy, allowing for plenty of air. The top and three of the four sides were made of canvas and consequently were pollen proof. The fourth side was made of cheese cloth. By using cages of this construction absolute protection against foreign pollination from three directions was effected, and at the same time the necessary ventilation of the cages was provided for. By, furthermore, having all the cheese cloth sides of the many cages in the breeding block facing in the same direction, viz: to the leeward of the prevailing winds, the danger of foreign pollination was minimized as much as possible.

Seed of good quality in satisfactory quantities was secured from the isolated plants.

2. Self-fertilized Grasses.—Among the cultivated grasses there is only one which so far is known to be normally self-fertilized, viz: *Western Rye grass* (*Agfopyrum tenerum* Vas). This species occurs in a tremendously large number of forces in Canada and it was when studying the wild forms with the object of coming to some understanding of their systematic relationship that the writer, in 1913, made the discovery that self-fertilization regularly takes place. The discovery was made at Edmonton, Alta., where a large number of Western Rye grass forms occur in the greatest profusion. The writer observed, when one day collecting a number of different forms, that the blossoming of the flowers presented some features, or rather lack of features, which indicated a mode of pollination different from that of other grasses. In the first place, it was noticed that, during the opening process of the glumes inclosing the sexual organs, the stamens did not protrude from

*Observations made by the writer during the summer of 1920 have revealed self-fertilization in other species of Agropyrum, viz: A. Richardsonii Schrad., A. biflorum (Brignoli), R.E.S., and A. caninum (L) Beauv.

between the glumes as is normally the case in grasses, but remained inside. Secondly, an examination of the anthers showed that they were very much smaller than the anthers of some other species of Agropyrum which apparently were normally wind-pollinated. These peculiarities naturally caused a closer investigation of the flowering process. Watching the blossoming with the aid of lens, it was observed that when the flowering glumes were in the act of diverging from each other, the anthers which mostly were to be found surprisingly far down in the "flower" suddenly exploded, bursting open from one end to the other, and sprinkling the pollen all over inside the flowering glumes. At the time of the explosion of the anthers the stigmas of the pistil were enclosed within the flowering glumes and consequently, they caught a substantial portion of the released pollen. When the glumes closed again, after the pollination was over, two of the three exploded anthers in a flower were generally found hidden at the bottom of the glumes. Sometimes all three were found in that position but more often one of them was found squeezed in between the edges of the glumes, protruding more or less but never hanging outside as in most other grasses.

Figure 3.—Western Rye Grass; high-yielding varieties.

It was further observed that the flowering process, *i.e.*, the opening up of the flowering glumes, the sprinkling of pollen on the stigmas of the pistil through the explosion of the anthers, and the closing of the glumes again, took less time in plants growing in the open than in plants growing in the shade of trees, and also that the opening up of the glumes was still more rapid in heads which had been cut off. The pollination process was studied on quite a large number of the forms occurring in the Edmonton district and it did not take very long before the writer was satisfied that, in the first place, self-pollination always took place, and, secondly, that the chances for the pistil of a flower being fertilized by pollen either from another flower on the same plant or from a flower on another plant were extremely small.

After these observations it was of course only natural to suspect that the various forms of Western Rye grass might normally breed true to type. In order to test the possible truth of this assumption, seed was collected, at Calgary, Alta., in the fall of 1913, from nine individual plants representing nine widely different types. The nine plants were all growing together, as a matter of fact so close together that a person could gather seed of three or four of them without moving. The seed collected from each plant was of course kept separate and the following spring sown in separate rows at the Central Experimental Farm. Ottawa. The year after seeding all doubt as to the breeding true to type of the different forms was removed. There was not the slightest variation observed in the progeny from any of the nine mother plants, every row being perfectly uniform in type (Fig. 1). Corroborating observations proving that the Western Rye grass forms breed true to type have since been made on material collected in various parts of Canada.

It is obvious that, with the numerous forms of Western Rye grass breeding true to type, the development of new agricultural varieties possessing constant characteristics is a very simple matter. All one has to do, to start with at least, is to collect promising forms, either in cultivated fields or in the wild state, and propagate them by seed. No isolation is necessary and, this being the case, a very large number of types can be worked with simultaneously. At present there are over one hundred different types, or varieties if you like, grown at the Central Experimental Farm at Ottawa. While most of these varieties are grown for the purpose of demonstrating and testing the constancy of the different types and while some of them are decidedly inferior agriculturally (Fig. 2) there are others which are promising to become of great agricultural value (Figs. 3 and 4).

3. **Alfalfa.**—In regard to fertilization, alfalfa presents some analogies to open-fertilized grasses in as much as fertilization may be effected by pollen from the same flower, by pollen from another flower of the same plant, or by pollen from a flower of another plant. This being the case the methods employed to develop uniform alfalfa varieties breeding true to type are, in their principles, essentially the same as those used for the development of constant varieties of open-fertilized grasses. As, however, the agencies which bring about the fertilization of alfalfa under natural conditions, viz: insects or mechanical impact, are different, the breeder's pollination manipulations must be modified accordingly. As, furthermore, pollen can be applied to the stigma of the pistil only once, on account of the well-known tripping peculiarity of the flowers, special care must be exercised by the breeder in the application of pollen to the pistil.

Even if every possible measure has been taken to secure pollination, the formation of seed may, however, often be found to be far from satisfactory.

Two main factors may account for imperfect seed formation, viz:

1.—Defective sexual organs.

2.—Unsuitable condition for seed development.

Concerning defective sexual organs it is well known to all who have had occasion to observe different alfalfa types that some types exist which under natural conditions regularly produce an abundance of seed while others, which may grow alongside, have practically no seed at all. This is particularly the case among types that are segregations from crosses between the true alfalfa (*Medicago sativa*) and Yellow

Lucerne (*Medicago falcata*). In other words, conspicuous differences in the seed-producing capacity of individual plants are common occurrences in the so-called variegated alfalfas, including Grimm's, Ontario Variegated, Baltic, Cossack, and others. It is difficult, indeed, to explain the existing variations in the seed-producing ability of different types except by assuming that the female reproductive organs in some types are normal while in others they are more or less degenerated or even wholly incapable of function. A cytological investigation of the sexual cells of the pistil of different alfalfa types would no doubt be productive of many interesting results.

While the failure to set seed in many cases may be attributed to lack of sexual vigour in the female organs, it must not be forgotten that failure to produce seed may also be due to impotent or more or less abnormal pollen being deposited on the pistil. In 1911, the writer had an opportunity to make some observations, for the first time, on the character of the pollen in a very large number of different types found in a field of Grimm's alfalfa at the Experimental Station, Lethbridge, Alta. It was observed that, while in the majority of types examined the pollen appeared to be normal, i.e. heavy, of full colour, and sticky as it generally is in plants pollinated by insects, there were quite a few types in which the pollen was abnormally pale, light and almost as dust-like as grass pollen. That latter type of pollen evidently was very inferior to the normal one. Numerous observations of a similar nature have since been made and there appears to be no doubt but that the male organs in many alfalfa types are imperfectly developed.

It is obvious, then, that no attempt should be made to fix an alfalfa type, i.e. to develop it into a constant variety, unless observations on its seed—producing ability and examination of its pollen have shown it to be sexually normal.

Granting that a sexually perfect plant of a valuable type is selected as mother plant, the breeder's only course in an effort to develop it into a constant variety is to resort to inbreeding through self-fertilization. Self-fertilization may be brought about either through self-pollination, effected simply by tripping the flowers by touch, or by tripping the flowers with a suitable instrument on which pollen from another flower of the same plant has previously been deposited. Both methods are known to bring results, but it also is well known that the setting of seed in many cases does not materialize.

The writer is inclined to think that in many cases, when seed formation fails to follow tripping on isolated material, one of the main reasons for the failure is unsuitable conditions for seed formation, on account of unsatisfactory isolation methods. The use of paper bags enclosing clusters of flowers has the same drawbacks here as in grasses, and in cages made of cheese cloth it is also difficult, at least in the east, to keep the atmospheric conditions in respect to heat and humidity, as close to the normal as would be desirable.

Next year it is planned to use roomy cages made of wire netting sufficiently open to allow ample ventilation, yet sufficiently close to prevent all insects capable of tripping the flowers from entering the cages.

4. Red Clover.—In the matter of pollination, Red Clover is unlike all the other forage plants which have been dealt with so far. A Red Clover plant is incompatible to its own pollen, i.e. it cannot produce any seed unless it is fertilized by pollen from another plant. This self-sterility was observed already by Darwin and, later, numerous investigators have corroborated Darwin's findings. Under the circumstances it is evident that it is not possible to develop pure varieties like for instance pure varieties in Wheat and Western Rye grass. Self-fertilization is out of the question and cross-fertilization must be resorted to.

Although pure varieties in the strict sense of the word can not be obtained, yet it is possible to develop varieties of a sort exhibiting a rather high degree of uniformity in respect to characters particularly bred for. A few examples illustrating the point may be given.

An ordinary sample of Red Clover seed is, as is well known, very mixed as far as colour is concerned, the individual seed varying from pale yellow to deep purple with all kinds of intermediates. If, however, seed of individual plants is collected and examined, it will be found that the ripe seed within each individual plant is of the same general colour. If two plants grown from, for instance, two purple seeds are cross-fertilized, the progeny resulting from the cross will to a large extent consist of individuals having purple seed. And if purple-seeded plants from among the

Figure 4.—Western Rye Grass varieties; differences in yielding capacities indicated by distances between stakes.

progeny of the original cross are again crossed, the purple seeded plants in the ensuing progeny will be greatly increased. It is thus possible to develop a variety of a sort characterized by a steadily increasing high percentage of purple seed.

Another example. Red Clover plants with four leaflets are frequently found; more rare are plants with five, six, and seven leaflets, in the order given. If two plants having 4-foliate leaves are crossed, there will appear in the progeny a certain percentage of 4-foliate plants and perhaps also some odd 5-foliate ones. By keeping on generation after generation to cross plants showing the greatest tendency to grow leaves with more leaflets than three or four it is possible to develop a race in which plants having all the leaves 3-foliate are rare.

From these two examples—and more could be quoted—which are taken from papers by European investigators dealing exhaustively with inheritance of characters in Red Clover, it is apparent that it is possible to develop by means of what may be termed

cumulative breeding, varieties exhibiting certain characters at an unusually high ratio.

This being the case, it is obvious that there is a possibility of developing high-yielding and in other respects desirable "varieties" by crossing two desirable types, preferably as similar to each other as possible in all characteristics, and by crossing again, generation after generation, plants of a type as identical as possible with the type represented by the two plants which originally served as parent plants.

This method of increasing the yielding power of Red Clover is, however, rather slow and the results may perhaps not prove commensurable with the time and labour which will be necessary to obtain them.

A more simple method leading to more speedy results may be successfully employed. The method involves mass-selection of the most desirable types through roguing-out of the undesirable one and is applied as follows: A field is planted to Red Clover of proven hardiness in such a manner that each individual plant can be examined as to its mode of growth, leafiness, etc. When the blossoming period is about to begin, all inferior or otherwise undesirable plants are weeded out. Seed is secured from the remaining ones. This seed is then sown and the weeding out operation repeated through a number of generations until a clover showing a very small percentage of inferior types is obtained. The obvious advantage of this method is that it permits large quantities of stock seed for propagation on a commercial scale to be quickly obtained.

The method of mass-selection may also be applied for the purpose of developing what may be termed "biological varieties". Thus it has been possible to develop, at the Central Experimental Farm at Ottawa, a "variety" characterized by an unusual high degree of perennialism. As starting material a few plants were used which according to observations made during a number of years, were at least five years old. The seed of these plants was mixed and sown in two plots. The year following the seeding one hay crop and one seed crop were taken from each plot. The following year a rather large percentage of the plants which the year previous had yielded both a hay crop and a seed crop, survived, thus indicating that, by using as starting material plants more than two years old, it may be possible to develop a perennial type of Red Clover.

Mass-selection may perhaps not be considered very scientific in this age of exact heredity investigations but, applied to Red Clover, it brings results in comparatively short time and is therefore of great practical importance.

Concerning the C. S. T. A. and Its Branches

By the GENERAL-SECRETARY

There have been many occasions since the Organizing Convention when the General-Secretary would have liked to communicate personally with all the members, in order to keep them advised of developments taking place and of other matters mutually interesting. During the months of November and December it was possible, when the writer attended meetings of members in each of the provinces, to tell those who were present something of the progress being made and of the more important work being undertaken. That information is embodied and some details added elsewhere in this issue.

The purpose of these columns is to provide a medium for monthly communication between the General-Secretary and each member and to give publicity to the operations of local and provincial branches. In making these items interesting and timely the members should co-operate fully. It is impossible for the Secretaries of branches to obtain all information regarding the work and movements of their members, and our immediate purpose will best be served by direct communications to the General Secretary.

CHANGES IN ADDRESSES SHOULD ALWAYS BE SENT IN PROMPTLY. This is very important and yet over forty members have changed their addresses in the past two months without forwarding advice to that effect. Without a correct up-to-date list of addresses, much of our usefulness will be lost.

Any important work done by a member, any change of position, any promotions, will afford interesting news for publication. It need not be sent in by the member concerned (he might forget to send it) but can be forwarded by anyone in possession of the desired information. The main object, as stated before, is to provide a channel through which the members may communicate by making use of the columns of Scientific Agriculture—and this is admittedly one of the objects for which the C. S. T. A. was formed. These pages will then become a very interesting record.

The operations and activities of branches of the Society should be communicated promptly by the Secretary of each, as a great deal of this information can be used to advantage.

The one matter to which the General-Secretary now wishes to draw the attention of members, is the importance of rapidly increasing the circulation of their official organ among non-members. No publication can be commercially successful without a mailing list considerably larger than is offered by the membership of the C. S. T. A. The Society is fortunate in having the control and guidance of the editorial policy and make-up of Scientific Agriculture, and that arrangement will continue if the publishers receive adequate encouragement from the Society in their effort to cater to a class of readers seeking a technical publication. In order to build up the necessary circulation, the members must play their part.

It is somewhat difficult in such a place as this to praise the publishing house. But in all fairness, every member should know that since the first of October last the Industrial & Educational Publishing Company, has absorbed (1) all the printing, postage and stationery charges of the C.S.T.A., (2) All the travelling expenses of the General-Secretary and (3) More than fifty per cent of the $2,500 salary at which the General-Secretary was appointed by your Dominion Executive.

The Relation of the Keel Bone to Egg Production

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Introduction.

For the past fifty years poultry has been selected for fine feathers, graceful curves and other features adding to their beauty. It was taken for granted for many years that egg production would take care of itself. Within the last twenty years this viewpoint has been gradually changing, particularly within the last few years.

This change has come about partly through the organization of egg farms where it was found that show points did not necessarily mean a good layer. Another factor was the observation by certain breeders that there was a change in size accompanying the change from the laying to the nonlaying condition or vice versa. This led to the development of so-called systems for culling hens for egg production. These were based on observations by the inventor of the "system" but were not backed by actual evidence. One of the best known of these was the so-called Hogan "system" which will be dealt with later.

Within the last few years experiment stations have taken up the work of determining whether there is an egg type and in what way certain structural characteristics are associated with production. Wilkins '15 did some work indicating the changes that would be expected to take place in a hen's appearance when changing from the laying to the nonlaying condition. The first and practically only extensive work done to date is that of Kent (5) in connection with a study of constitutional vigor. He has shown quite clearly that many of the anatomical characters studied in this experiment are related to laying conditions. A general type as indicating productive ability is also pretty generally accepted but not enough data are as yet available showing to what extent total annual production varies with variation in structure.

Object.

The object of this experiment was to determine to what extent the keel bone is related to egg production and further to determine whether its relative position is in any way related to total production, or the distribution of egg production. A study was also made of the size of abdomen and the pelvic structures to determine their relation to egg production and partly to test the reliability of the Hogan "system." A study of the measurements taken in their relation to broodiness was also made because of the effect of this condition on total egg production. The object in each case was to determine to what extent variation in structure is related to variation in production with a view to finding their value in selecting birds for egg production.

Stock.

Eight pens of single comb White Leghorn hens from the general heredity experiment flocks of the Poultry Department, at Cornell University, were used in this experiment. Two of these pens were made up of low line birds and six of high line birds or birds bred for high egg production. Besides these about twenty hens culled for market were measured. The total number of birds used in the following tables is 280. Over half the birds measured were finishing their first laying year while the rest were finishing their second year of laying.

The birds within each line are fairly homogeneous so far as breeding goes but no attempt was made to compare the high and low lines. The range of production was as great as might have been expected with unselected birds and it is believed that the birds used are a fairly representative random sample of single comb White Leghorn hens.

Measurements.

All measurements were made by the writer, another person holding the birds. The accuracy of the measurements depends somewhat on the man holding the birds but it was impossible to have the same man do this all the time. This disadvantage was probably sufficiently offset by the care taken with the measurements. The measurements were all made the latter part of October and early part of November 1919, the period covering about four weeks.

The measurements were made with calipers measuring to millimeters. No attempt was made to measure closer than this but in averaging results all figures were carried to hundredths of a centimeter. All except about ten birds were measured twice and some showing slight discrepancies were measured three times. Of the ten birds measured only once, one died, while the others were sold before a second measurement was made. The results from these were, however, fairly consistent with the rest so that there probably was little or no error from this source. The weights of all birds were recorded each time that they were measured, and the average weight used. For this purpose a spring balance weighing to ten grams was used and the weight estimated to the nearest five grams.

The following were recorded:—

1. WEIGHT.

2. LENGTH OF KEEL.—Measured by pressing the calipers on the ends of the keel. This measurement was quite consistent, rarely varying more than one millimeter on any bird for the different times measured.

3. CURVATURE OF THE KEEL.—To get this three measurements were made with the calipers, one from the antero ventral, one from the midventral and one from the postero ventral surface of the keel to a point selected on the back. This point was the antero dorsal surface of the ilium which forms a prominence easily felt on the back of the fowl. The accuracy of these three measurements depended largely on the pressure exerted. Great care was taken to discover any discrepancies and where these occurred, a third measurement was taken to ensure accuracy, the average for the three being used.

4. ABDOMEN.—Measured by placing the thumbs one against the end of the left pelvic bone and the other against the posterior end of the keel. The calipers were then placed against the thumbs. As with the last measurements, accuracy depended largely on the pressure exerted, particularly on the keel, and it was necessary to exercise care in having the birds all held in the

same relative position when measured. Otherwise this measurement was not hard to make and was fairly consistent.

5. DISTANCE BETWEEN THE PELVIC BONES.—Measured by placing the thumbs against the end of the pelvic bones and bringing the calipers against the thumbs. Much depended on the pressure exerted on the pelvic bones and with the calipers against the thumbs so that this measurement like all the others is relative only.

6. BREADTH AT HIP.—Measured by pressing the calipers on the bony structure just back of the hip bones. More experimenting was done to determine where to make this measurement than with any other but in spite of this the results were sufficiently consistent to indicate that they were relatively accurate.

Besides these the following were estimated:—

1. PELVIS OR BODY WALL including pelvic bone estimated to sixteenthes of an inch. This was only relatively accurate.

2. STRAIGHTNESS OF KEEL.—Divided into five classes, class one straight, class five very crooked and the rest intermediate. Class two was very slightly crooked and would ordinarily be called straight.

3. CONDITION.—The birds were divided into five classes as to condition, class one in very good condition, class five very thin, and the rest intermediate. This classification was based largely on the amount of flesh on the keel and also on the fat deposited in the abdomen. Most of the birds fell in class two as in fairly good condition. A mental scale was used for these estimates but as the same person did all the estimating, the results are believed to be relatively accurate and were found to show little variation.

A note was also made of whether the birds were in laying condition. In all tables contrasting laying with nonlaying hens, all birds that were laying when one of the measurements was taken are classified as layers except where otherwise stated.

The other data used were taken from the records of the poultry department and include total production for the year; intensity of egg production as shown by highest monthly egg production; duration of laying period, represented by months; and lastly, seasonal distribution of egg production as shown by egg production November first to February twenty-eighth inclusive, March first to June thirtieth inclusive, and July first to October thirty-first inclusive. These are all based on records for the hen year November first 1918, to October thirty-first 1919, inclusive. It will be seen from this that the first or winter period is the farthest removed from the time that measurements were taken.

Records of broodiness and of the weight of eggs laid also obtained for the same period. The latter were based on the averages for the weights of all eggs laid every fourth week for the entire period.

Experimental Results.

In order to show the relation between total egg production and distribution of production, correlation tables of these were made. The coefficients obtained are given in Table 1. There is a high corrolation in each case so that any measurement showing a correlation to egg production would also be expected to show a correlation with one or the other of those showing distribution.

From Table 1, it will be noticed that there is no correlation between length of keel and total annual egg production or length of laying period as expressed in the number of months. This latter result is further strengthened by the absence of correlation between length of keel and winter egg production and late summer of July 1—October 31st production. It will be seen that there is some correlation between length of keel and highest monthly egg production. There is also some relation to March 1st—June 30th production, but this is so small that it can hardly be considered significant unless further data show the same results.

By referring to Table 1, it will be seen that there is some correlation between straightness of keel and total egg production, while the next coefficient of correlation shows that there is no relation to intensity of production. To further test the relation of straightness of keel to production, all the birds were divided into two groups, those that were classified as three or more falling into the crooked keeled group and the rest in the straight keeled group, since groups one and two were practically straight keeled. There were one hundred birds in the first group and one hundred and eighty in the straight keeled group. The average duration of laying period was 9.2800 ± .1183 months for the first group and 8.8944 ± .0853 months for the second group, showing that there is practically no rela-

Table 1.

Subject.	Relative	Coefficient of Correlation
1. No of months laid	Total Egg Production	.8926±.0082
2. Highest Monthly Egg Production	" " "	.7415±.0181
3. Egg Production. Nov. 1--Feb. 28	" " "	.6952±.0208
4. " " Mar. 1--June 30	" " "	.7816±.0157
5. " " July 1--Oct. 31	" " "	.8355±.0122
Length of Keel	" " "	.0319±.0403
" "	No. of Months Laid	—.0605±.0402
" "	Highest Monthly Egg Production	.1799±.0340
" "	Egg Production, Nov. 1—Feb. 28	—.0897±.0400
" "	" " Mar. 1—June 30	.1232±.0397
" "	" " July 1—Oct. 31	.0550±.0402
Straightness of Keel	Total Egg Production	.1639±.0392
" "	Highest Monthly Egg Production	.0908±.0400
Curvature of Keel	Total Egg Production	—.1157±.0398
" "	No. of Months Laid	—.1176±.0397
" "	Highest Monthly Egg Production	—.0355±.0402
Length of Keel	Total Egg Production	—.3256±.0360
Weight of Birds.		

tion to distribution of production so far as number of months go. Crooked keeled birds show a somewhat higher mean winter production than the straight keeled birds or 33.9000 ± .7203 and 29.7220 ± .9366 eggs respectively. The difference is not great but probably significant. It has been suggested that crooked keeled birds start to lay earlier as pullets than those with straight keels. As has been stated before, over half the birds used were finishing their first year's production so the result obtained seems to indicate that this relation holds true.

Patterson and Quisenberry (7) state that straight keeled birds laid more than crooked keeled birds or as follows: straight keeled birds 100 per cent, slightly crooked keeled birds 91 per cent, and decidedly crooked keeled birds 68 per cent. These results are clearly contradictory to those obtained in this experiment and may be due to difference in stock or in management or both.

In order to get an expression for the curvature of the keel three circles or arcs of circles were drawn from one point, using as a radius the measurement from the back to the antero ventral, midventral and postero ventral surfaces of the keel. With a small rule measuring to millimeters, a straight line was then drawn equal to the length of the keel from the circumference of the first circle to the last circle. From the middle of this line, a perpendicular line was drawn to the circle representing the distance from the back to the midventral surface of the keel. This line was then measured and used as an expression of the curvature of the keel. The operation was repeated for each bird.

There is a slight negative correlation of curvature of keel with production as shown by the coefficients given in Table 1. The coefficient of correlation in each case is so small, however that in view of the probable errors they cannot be considered significant.

The get the relation of the length of keel relative to the weight to egg production the length of keel was divided by the weight and the result correlated with production. This is shown in tables one and two. There is a significant negative correlation here but it is worth noting that this is caused largely by the position of a few individuals.

It is quite probable that these were abnormal as to weight at the time thus changing the correlation sufficiently to give a rather large negative coefficient. In view of the result with the length of keel it seems somewhat doubtful whether this is of any significance as far as selection goes unless further work shows the same result.

In order to get an idea of whether the position of the keel relative to the back was related to egg production the measurement back to posterior end of keel was divided by the measurement from the same point on the back to the anterior end of the keel. The first measurement is almost a direct measurement of depth of body at that point but the latter is also affected or modified by length of keel. This can therefore at best be considered only an indication of the relative distance of the anterior and posterior ends of the keel from the back. The expression thus obtained was correlated with production and the result is shown by the coefficients given in table one. The coefficients of correlation obtained are significant and indicate that the relative position of the keel may be related to production but to establish this more direct methods and further data are required.

From table 3 it will be seen that distance between the posterior end of the keel and the pelvic bones is related to total production. It will be noted that the relation is rather to length of laying period than to intensity of production. Little correlation is shown between the size of abdomen and periods of production far removed from the time at which the measurements were taken, but there is a significant correlation to the last period (July 1—October 31) indicating that this measurement varies with laying condition. To test this the birds were divided into two groups, laying and nonlaying, with forty birds in the first group and two hundred and forty in the latter. The mean size of abdomen was 5.7225±.0913 cm and 4.2788±.0386 cm respectively, showing a decidedly significant difference which agrees with results obtained by Kent (5). This variation should be taken into consideration when selecting birds by size of abdomen, though size of bird should also be considered.

Table 3.

Subject	Relative	Coefficient of Correlation
Size of Abdomen. . .	Total egg production	.2280±.0382
(Dist. Keel to Pelvis)	Highest Monthly Egg Prod.	.1439±.0395
"	No. of months laid	.2346±.0380
"	Egg Prod. Nov. 1 –Feb. 28	.1338±.0396
"	Egg Prod. Mar. 1—June 30	.1398±.0395
"	Egg Prod. July 1—Oct. 31	.2095±.0385

Table 2.

	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28	29-30	
.00450—.00549	.	2	.	2	3	9	5	1	1	23
.00550—.00649	.	3	7	12	18	22	14	6	3	85
.00650—.00749	.	2	11	19	30	33	15	6	2	118
.00750—.00849	.	3	6	8	6	11	4	1	.	39
.00850—.00949	1	.	1	3	4	1	.	.	.	10
.00950—.01049	.	1	.	.	.	.	.	.	.	1
.01050—.01149	1	.	1	.	.	.	.	.	.	2
.01150—.01249	.	.	1	.	.	.	.	.	.	1
.01250—.01349	.	.	.	.	.	.	.	.	.	0
.01350—.01449	.	.	1	.	.	.	.	.	.	1
	2	11	28	44	61	76	38	14	6	280

Length of Keel divided by Weight of Bird, subject. Highest Monthly Egg Production, relative.
Coefficient of Correlation = — .2896 ± .0369.

Table 4.

Subject.	Relative	Coefficient of Correlation
Dist. Back to Front of Keel.	—Total Egg Production	.2530±.0377
" " " "	No. of Months Laid	.1864±.0389
" " " "	Highest Monthly Egg Production	.2965±.0368
" " " "	Egg Production Nov. 1—Feb. 28	.1492±.0394
" " " "	Egg Production Mar. 1—June 30	.2334±.0381
" " " "	Egg Production July 1—Oct. 31	.1882±.0389
" " Posterior End of Keel.	—Total Egg Production	.3684±.0348
" " " " "	No. of Months Laid	.3026±.0366
" " " " "	Highest Monthly Egg Production	.3914±.0341
" " " " "	Egg Production, Nov. 1—Feb. 28	.2500±.0378
" " " " "	Egg Production, Mar. 1—June 30	.3322±.0359
" " " " "	Egg Production, July 1—Oct. 31	.3174±.0362

From results obtained by measuring 160 birds entered in the sixth poultry egg laying competition at Harper Adams College 1917-18, for length of keel, width at hips, distance between pelvic bones and size of abdomen it is concluded that size of abdomen is the best indicator of laying capacity. This is decidedly not in agreement with the results of this experiment as will be seen from an examination of the tables, both width at hips and distance between pelvic bones showing a higher correlation to total production. The original reference is not available so there is no way of telling how this result was arrived at.

The three measurements from the back to the keel described in connection with curvature of keel are the only ones taken that give any indication in what way depth of body is related to egg production. As has been mentioned before the measurement to the posterior end of the keel, while not a direct measurement of depth, comes nearer to being that than the measurement to the front of the keel. The latter is so closely correlated to the measurement back to middle of keel that that measurement was not used for correlating with production.

The correlation of the measurement back to front of keel to egg production is shown in table 4. The greatest correlation is shown with total production and intensity of production or highest monthly egg production. While there is no very marked increase in correlation from one period to the next it is well to note that the correlation with egg production to March first is probably significantly less than for the later periods. The mean distance back to front of keel was 12.5000±.0551 cm for the 40 hens in laying condition and 12.0383±.0293 for the 240 hens that were not laying showing that this measurement varies with actual laying condition.

Table 4 includes a similar set of data, as just considered for the measurement back to posterior end of keel. That this measurement is also dependent on laying condition is shown by the means 11.9775±.0655 cm and 11.0817±.0361 cm for the layers and nonlayers respectively. There was also a great variation in range the laying hens varying from 10.80 to 13.79 cm while those that were not laying varied from 8.30 to 13.29 cm. There is also an appreciable difference between the correlation with production to March first and the other two periods which do not vary to any great extent. All the correlations are significantly higher for this measurement than the last. These two sets of data indicate that depth of body is correlated with egg production and since the latter measurement, as has been pointed out, is the more direct measure of actual depth the higher coefficients of correlation are to be expected. An interesting feature of these data is that in each case the coefficient of correlation is the greatest for highest monthly egg production. This would seem to indicate that depth of body is rather closely correlated with intensity of egg production.

(This article will be concluded in the February issue.)

WORLD AGRICULTURE

Many members of the Canadian Society of Technical Agriculturists have recently received a complimentary copy of "World Agriculture" and a request to sign an enrolment form as members of the World Agriculture Society. The development of that organization and the objects for which it stands are plainly stated in the enrolment form, and need not be emphasized here. The movement is world-wide, is receiving splendid encouragement, and financial help received from members is devoted only to the printing of "World Agriculture" and other necessary expenses. The organization stands for educational advancement and is in no sense a commercial enterprise.

During the past few months there has been close co-operation between the World Agriculture Society and the C. S. T. A., through the Secretaries of the two organizations and Mr. Laurence H. Parker, of Amherst, Mass., who is also the Editor of "World Agriculture" has already done much to bring the C. S. T. A. and its official organ to the notice of his world-wide audience.

In many ways we can be, and should be, reciprocal. Those who are directly associated with the World Agriculture Society can always feel assured that they have the sympathetic—and we hope financial—support of the members of the CANADIAN SOCIETY OF TECHNICAL AGRICULTURISTS.

Communications in regard to the World Agriculture Society should be addressed to Laurence H. Parker, Agricultural College, Amherst, Mass., U.S.A.

WHO'S WHO.

From the membership of the Canadian Society of Technical Agriculturists, an excellent "Who's Who in Canadian Agriculture", might be prepared. Have our readers any suggestions to make in this matter? It might be possible to collect the necessary material during the next six months, and subsequently publish it in sections, in current issues of "Scientific Agriculture".

Animal Fibres Used in the Textile Industry

ALDRED F. BARKER, Principal of Industrial School, Leeds University, England.

Raw Materials.

The raw materials employed in the Textile* Industries are derived from the three kingdoms of Nature—the Animal, the Vegetable and the Mineral. To these three types of materials has recently been added another type—the artificial—of which artificial silk is the chief, though by no means the only, representative.

To illustrate the value of systematic thought and work it will be well to set out the possibilities of yarn and fabric production from these typical fibre-substances, thus:—

1. Animal,
2. Vegetable,
3. Mineral,
4. Artificial,
5. Animal + Vegetable,
6. Animal + Mineral,
7. Animal + Artificial,
8. Vegetable + Mineral,
9. Vegetable + Artificial,
10. Mineral + Artificial,
11. Animal + Vegetable + Mineral,
12. Animal + Vegetable + Artificial,
13. Vegetable + Mineral + Artificial,
14. Vegetable + Vegetable + Mineral + Artificial.

Of the fourteen classes Nos. 1, 2, 4 and 5 only are really important although in view of the importance of Asbestos to Canada and of the recent developments in the manufacture of artificial wool in England, Nos. 3, 6, 7, 8, 9, 10 and 12 should be given some consideration. Notice should also be taken of the absence of silk from this list. This fibre, which falls, as one would expect, between the Animal and Vegetable types, partakes of certain of the characteristics of both the Animal and Vegetable fibres. In view of the large stores of this fibre in the equatorial forests of the world, this fibre is likely, in the near future, to markedly extend its field of usefulness.

Each of these classes of fibres may be divided into sub-classes and it will frequently be desirable to divide up even these sub-classes. Thus, Vegetable fibres may be divided into Seed and Stem fibres—but there are many varieties of Seed fibres—such as Cotton and Kapok—and also many varieties of Stem fibres—such as Flax and Ramie or China grass.

The Animal Fibres.

It will be useful to study these under the headings:—

(*a*) The fibre-producing animals.

(*b*) The animal fibres.

And here it will be well at once to guard against the prevalent heresy that it is no concern of the merchant nor of the manufacturer where his fibres come from nor how they have been developed. The lesson of the building up of the great mills at Saltaire by the accidental re-discovery of a new animal fibre—Alpaca—by Sir Titus Salt (and many other similar examples could be quoted) has not yet been taken entirely to heart. Such institutions as the Universities of Edinburgh and Leeds and the British Woollen & Worsted and other Research Associations are, however, doing yeoman service in bringing producer and consumer closer together and much is to be hoped for from this combination.

* Textile=woven or capable of being woven.

Casual thought about the animals from which the textile fibres of commerce are derived will speedily reveal three classes:—

Hairs, Furs and Wools.

It would seem safest to regard the skin as the common parent of this triplet; for, as will be shown directly, it is improbable that hair was ever wool or wool hair, and the differences between fur and hair, and fur and wool, and hair and wool are such that it is perhaps safer and more useful to regard each as a separate skin derivation differentiating though not to the same extent, as one would differentiate between, say, hair and feathers; or perhaps, better still, between the scales of fishes and the feathers of birds.

The following graph probably gives the correct idea of the origin of the various hairs, furs and wools of Commerce:—

GRAPH I.

Common Ancestor.

Goats. Camels. Sheep.

Of the Goats the principal representative is the Angora, which, originating in Asia Minor, has spread to South Africa, California and Australia. Mention should also be made of the Cashmere Goat from which an underhair of remarkable softness and fineness is procured. If Mr. Stefansson is successful in domesticating the Musk Ox and in obtaining supplies of the under-wool in commercial quantities, then another useful group or sub-group of the producing animals will be added here.

Perhaps it may be well here to note that not only the Musk Ox but also the Urial Sheep presents the curious arrangement of a hairy coat, apparently to throw off water, and a soft under-coat, apparently to keep the animal warm. Knowledge of this fact led Professor Cossar Ewart, when lecturing to Australian students in the University of Leeds during 1919, to suggest that possibly in the strong mountain breeds of sheep, the strong hair has been developed and the soft under-coat entirely or partially bred out, and that in such breeds as the Soay and Merino the strong hairy coat has been bred out and the soft under-coat developed. As further proof of this, Professor Ewart stated that he had actually found the fine undercoat of the present-day Urial to be as fine as the finest merino. The Scotch Blackface also carries two coats, one of coarse hair and the other of fine wool.

* * * *

Of the Camels the chief representative is the true Camel, from which large quantities of hair—usually exported from Russia or China—find their way into the textile manufacturing centres of the world. An almost equally important group is the South American representative of the Camel tribe known as the Llama. The following graph gives the relationship of the present-day representatives of this group along with the crosses.

GRAPH II.

Huanaco.

Vicuna. Alpaca. Llama.

Special Cross Special Cross

At present all these animals are limited in range to the Andes and altitude seems to have played a great part in their development. Thus, the Llama (Fig. 1) is found at the lower altitude; the Alpaca (Fig. 2) will not thrive below 12,000 feet and the Vicuna (Fig. 3) appears to be a small wild variety, the domestication of which is just being attempted.

* * * *

Of the sheep of the world, volumes could be written but it is only desirable to here give those examples and particulars which will enable the student of the Wool Industries to intelligently survey the sources of supply of raw materials and perhaps to speculate upon possible improvements in the qualities and quantities produced.

Until the recent investigations of Professor J. Cossar Ewart, of the University of Edinburgh, no satisfying explanation of the evolution of the domesticated sheep was forthcoming. Even now the picture is by no means completed. After many journeyings through the world, and special visits to sheep rearing countries and the study of many types of sheep and allied animals, Professor Ewart discovered the key to the position in the little island of Soay off the coast of St. Kilda, Scotland. Here he found living in uncontaminated seclusion a short-tailed sheep which he eventually recognized as the sheep which was spread over Europe in the Stone Age, the relics of which were continually being found in lake villages and cave dwellings. The island of Soay (Sheep Island) would be the extreme northwestern point of the continent of Europe before the British Isles became separated from the continent by the North Sea, but the ancient breed of sheep would not have been found there in their pure unadulterated form but for the fact that it is extremely difficult to land on this particular island and that consequently from year to year little disturbance of the flocks of sheep living there has occurred.

Figure 2.
Young Alpacas, approximately 3 months old.

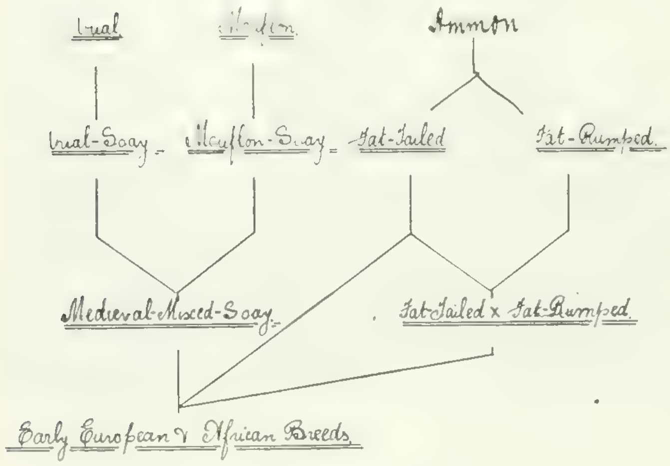
Here, then, was the key, but how was it to be employed to reveal what had happened? The story is too long to be followed out fully here but it includes investigation of the Urial sheep of Central Asia, the Moufflon of Sardinia, and the fat-rumped sheep and the fat-tailed sheep hailing from Central Asia. The absence of the long tail in the Soay sheep (Fig. 4) and the very much-in-evidence tail of the fat-tailed sheep (Fig. 5) of course formed one line of research. The migrations of the Nordic, the Alpine and the Mediterranean races formed another line of research. And so although the story is not

Figure 1.
Llamas.

Figure 3
Male and Female Vicunas.

yet completely built up the following graph fairly accurately represents what has actually occurred.

GRAPH III.



It is probably upon the more or less mixed breeds of sheep thus produced that all modern breeds of sheep are based. The Old Testament record of Jacob's method of breeding is suggestive of "how the sheep got its white coat," while Arab and Moorish traditions point to the probable evolution of the Merino breed along the shores of the Mediterranean.

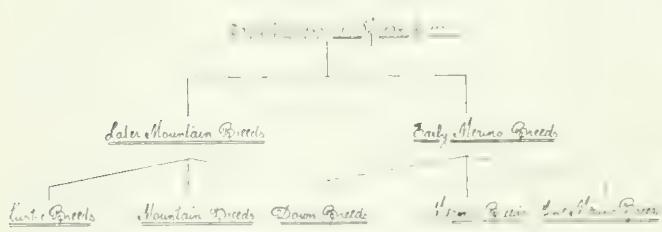
Broadly, the evolution of the really modern breeds of sheep has been based upon.—

(*a*) Racial tendency to variation.

(*b*) The direct and indirect action of the varied environment tending to produce variation.

Natural and artificial selection working upon these variations have resulted in the evolution of the typical breeds of sheep probably on the lines indicated in the following graph.

GRAPH IV.



Thus the sheep in evidence today are:—

(*a*) The Lustre breeds which have probably been derived from the Later Mountain Breeds by actual selection and crossing acting through many generations. Such breeds are the Wensleydale, Lincoln, Leicester, Long Devon, etc., etc.

(*b*) The Mountain Breeds—of which the most important are the Blackfaced and Herdwick. The Welsh is a Mountain sheep with much Down blood in it and judging from the crosses produced between it and the Soay, not very far removed from the pure Soay. The Cheviot, another Mountain breed, has also a strong Down foundation but is nearer to the true mountain,—or possibly Lustre-breed—than is the Welsh. It is not likely that there is any truth in the suggestions which have

Figure 4.
Soay Sheep.

been made that both the Cheviot and Herdwick breeds, localized on the north-east and north-west coasts of England respectively, have developed from crosses between the native sheep and the Spanish sheep which swam ashore from wrecked ships of the Spanish Armada. Curiously enough, however, in the north of Scotland the peasants to this day use peculiar colourings in knitting and weaving which certainly suggest a distinctly Spanish influence.

(*c*) The Down breeds are now considered true breeds but almost certainly have blood derived from the Merino sheep presented to George III, or possibly from even earlier Merino sheep. Although this is often denied, it is worth noting that when Professor T. B. Wood, of Cambridge University, in his search for a big sheep carrying a heavy fleece of fine wool, crossed the Shropshire (a Down type of sheep) with the Merino, the first cross showed distinct segregation—in other words, arguing on

Figure 5.
Fat-tailed Sheep.

Mendelian lines, the two parents were not pure. As the Merino rams were almost certainly pure, it almost certainly followed that the crossing results showed a strain of Merino blood in the Shropshire ewes. Many cross-bred sheep are produced in Australia, New Zealand and South America by crossing the Merino with Lustre or Down sheep. In some few cases—for example, in the case of the well-known Corriedale breed—it is claimed that by many years of careful selection of rams and culling of ewes a stable breed has been produced. Mendelian research makes one very chary of accepting this claim without most careful substantiation, but certainly suggests the truth of a Colonial saying "three generations to find a new breed and twenty to fix it."

(*d*) The Merino breeds which, in a rough form. were probably developed along the shores of the Mediterranean and carried by the Moors into Spain, were so successfully developed that for many years Spain supplied the wool manufacturer of the world with practically all his fine wool. Then Saxony and Silesia ousted Spain from the wool markets of the world and were in turn ousted by Australasia. Today the Merino sheep is strongly in evidence in Australasia, South Africa, South America the United States, and, as a special breeding sheep, in France (the Rambouillet). It still varies very much even in its pure form. Thus, the South American merinos usually produce the strongest merino wool, and the merino sheep of the inland districts of Australia and Tasmania and the Cape some of the finest merino wool grown.

Efficiency of the Agglutination Test for Contagious Abortion of Cattle

DAN. H. JONES, Professor of Bacteriology, Ontario Agricultural College.

The agglutination test for contagious abortion of cattle has been recommended by various investigators as a fairly satisfactory and practical method for determining which animals in a herd are likely to give trouble, either by aborting or acting as carriers of the infection, thereby causing others to abort. Thus the test should be an aid in the eradication of the infection from a herd, as it indicates which animals should be segregated.

During the summer of 1920 it was the writer's privilege to make the agglutination test for contagious abortion on a herd of 33 pure-bred beef cattle, including Shorthorns, Aberdeen-Angus and Herefords, and a herd of 34 pure-bred dairy cattle including Holsteins, Ayrshires and Jerseys. After the tests were completed the previous history of the individual cows was obtained from the herd books to determine to what extent the positive and negative findings of the test were confirmed thereby.

The test fluid used was a mixture of five strains of "*B. abortus*". Three of these strains were obtained from Dr. Huddleson, of Michigan Agricultural College, and the other two from Dr. Rettger, of Yale. Cultures of these strains were made on nutrient agar slants and grown for 72 hours at 37°C. The growth was then removed and mixed with physiological salt solution, filtered and diluted until a light clouded condition obtained. The blood samples were obtained from the jugular vein with sterile hypodermic needles. These were clotted in the ice-box over night, then centrifuged and the serum added to test tubes containing the test fluid, giving dilutions of the serum 1-100 and 1-50 in duplicate. The samples were then incubated at 37°C. for 48 hours. Negative results were recorded if both dilutions remained clouded same as control, positive if both cleared with formation of agglutinated clumps of bacteria, and doubtful if the higher dilution remained clouded and the lower dilution cleared.

The beef herd was made up of 22 breeding cows 2 years old or over, 8 calves and 3 yearlings not bred. The results of the test in this herd are as follows:

Breeding cows that gave a positive reaction and had history of abortion. . . .	8
Breeding cows that gave a negative reaction and had no history of abortion. .	4
Value of test confirmed by	12
Breeding cows that gave a positive reaction and had no history of abortion. .	8
Breeding cows that gave a negative reaction and had history of abortion	1
Value of test negatived by	9

The group of 8 that gave a positive reaction and had no history of abortion included a 3-year-old that had had 2 calves but was now difficult to breed, and an 11-year-old that had had 9 calves and was again in calf after requiring six services. There is a possibility that an invasion of "*B. abortus*" might have been responsible for the difficulty in breeding in these cases, though, needless to say, other factors might have been responsible. All the rest of the animals in the group had had calves and were again in calf without any trouble, notwithstanding the fact that they gave a positive reaction.

Taking the above figures as they stand in conjunction with the abortion history of these breeding animals, the efficiency of the test is as 12 to 9, or a percentage efficiency of 63.6.

Calves that gave a negative reaction	8
Calves that gave a positive reaction	0
Yearlings not bred that gave a positive reaction	2
Yearlings not bred that gave a negative reaction	1

One of the two positive reacting yearlings was from a dam 13 years old that had had 12 calves and gave a negative reaction; the other was from a 4-year-old dam

that had had two full time calves and has calved satisfactorily since the test, but gave a positive reaction.

As these yearlings had been mixing freely with the herd it is possible that those that gave a positive reaction had contracted the infection. It will be interesting to follow their subsequent history.

The dairy herd comprised 29 breeding cows 2 years old or over, and 5 yearlings not bred.

The results of the test on this herd are as follows:

Breeding cows that gave a positive reaction and had history of abortion. . . .	2
Breeding cows that gave a negative reaction and had no history of abortion	19
Value of test confirmed by	21
Breeding cows that gave a positive reaction and had no history of abortion	3
Breeding cows that gave a negative reaction and had history of abortion	1
Value of test negatived by	4
Breeding cows that gave a doubtful reaction and had no history of abortion . .	4
Breeding cows that gave a doubtful reaction and had history of abortion	0

It is difficult to decide in which category, for or against the test, these 4 doubtful reactors should be placed. Seeing that the reactions were not distinctly positive and that none of the animals had history of abortion or difficulty in breeding the balance would appear to be in favor of the test. However, on the other hand seeing that the tests were not distinctly negative, some may contend that the findings should be considered against the test.

If we leave the doubtfuls out of consideration and estimate the value of the test on the same basis as for the beef herd, we find the efficiency of the test to be as 21 to 4, or a percentage efficiency of 84.

Yearlings not bred that gave a negative reaction. .	3
" " " positive reaction . .	1
" " " doubtful reaction. .	1

As in the case of the yearling beef animals these dairy yearlings had been running with the breeding cows and so those giving positive reaction might have picked up the infection.

In both these herds abortion has been occurring for years. Some seasons only a few cases were in evidence while in other seasons the number of abortions approached an epidemic.

Seeing that in the beef herd 8 out of 21 breeding cows had given a positive reaction yet had never, according to their history, aborted or given trouble in breeding, and that 1 had given a negative reaction and yet had aborted, the manager is somewhat dubious about the advisability of taking the trouble to segregate the reactors from the non-reactors.

It has been concluded by Schroder and Cotton, after prolonged investigation, "that cows often remain carriers of abortion bacilli long after they have ceased to abort; and that cows that have never aborted and regularly and normally produce seemingly healthy calves, may be chronic carriers and disseminators of abortion bacilli; and that the abortion bacillus in an obligatory parasite so far as determined, hence the chronic persistence of the microparasite in the bodies of infected cows probably is the most important among the causes responsible for the propagation, the perpetuation and wide prevalence of the disease."

In view of the above, and taking into consideration that the agglutination test has been shown by a number of investigators to be equal in value to the more difficult complement fixation test, we consider that segregation of positive reactors to the agglutination test for contagious abortion is the only logical procedure and would be of great help in an attempt to eradicate the infection from a herd.

EXCHANGES.

Exchanges of "Scientific Agriculture" with other agricultural publications can be arranged upon application. We have already made arrangements to receive the Farmers' Advocate, Grain Growers' Guide, Experiment Station Record, United Farmers' Guide, Journal of Agriculture, Abstracts of Bacteriology, The Agricultural Gazette, International Review of Agricultural Economics, International Review of the Science and Practice of Agriculture, Journal of Agricultural Research, Canadian Countryman, Canadian Farm, Weekly Bulletin of Department of Trade and Commerce, L'Agronomie Coloniale, Agricultural Index, Canadian Horticulturist, Journal of Heredity, American Journal of Botany, Scientific Monthly, Farm and Dairy, Soil Science, Le Bulletin des Agriculteurs, and other publications.

NEW MEMBERS.

If there are any University graduates receiving this magazine who are not members of the Canadian Society of Technical Ariculturists, and who wish to join, they should communicate at once with the nearest local or provincial secretary, or with the General Secretary. Full particulars will be furnished upon application.

The membership list is increasing rapidly, and the names of new members will be published in current issues of "Scientific Agriculture".

OFFICERS ELECTED FOR WESTERN CANADIAN SOCIETY OF AGRONOMY.

At the recent annual meeting of the Western Canadian Society of Agronomy, the following officers were elected for the ensuing year:—

President:—T. J. Harrison, Agricultural College, Winnipeg, Man. Vice-President—G. H. Cutler, University of Alberta, Edmonton, Alta. Secretary-Treasurer—R. Hansen, University of Saskatchewan, Saskatoon, Sask.

Members of Committee—F. S. Grisdale, Agricultural School, Olds, Alta.; W. C. McKillican, Experimental Farm, Brandon, Man.

Biennial Fruit Bearing in the Apple

J. W. CROW, Ontario Agricultural College, Guelph, Canada

Biennial bearing is not a fixed characteristic of the Duchess and Wealthy varieties. It is brought about by the development in one year of blossoms on too large a percentage of spurs. Alternate bearing trees commonly show in their fruiting year fruit buds on from 60 to 90 per cent of their fruit spurs. From 30 to 50 per cent of these would be sufficient to produce a full crop. Growths on bearing Duchess and Wealthy trees are of six distinct types, based on their position and on the behaviour of their terminal buds.

(1) Weak leaf spurs, making 1 to 2 mm. of growth annually. So long as they make only this amount of growth they do not set fruit buds.

(2) Axillary leaf spurs, 1 to 3 mm. in length, produced as lateral growths on blossoming spurs. They rarely produce fruit buds in the season of their origin but normally do so the following year.

(3) Weak fruit spurs, 3 to 4 mm. in length. They blossom but seldom produce fruit.

(4) Strong fruit spurs, 4 to 9 mm. in length. These bear nearly all the fruit. Individual spurs bear every second year and rarely blossom two years in succession.

(5) Extra long fruit spurs (or shoots). With some varieties shoots from 10 to 200 mm. in length occasionally produce strong terminal fruit buds.

(6) Non-fruiting shoots of lengths varying from 10 mm. up to 500 mm. or more. The majority of the longer growths on a tree are of this nature.

The percentage (from actual count) of growths falling in each category is as follows:—

TABLE No. 1.

CLASS	1 mm. 1-2	2 mm. 1-3	3 mm. 3-4	4 mm. 4-9	5 mm. 10-200	6 mm. 10-500
1. Alternate bearing tree, in *on* year..	2-6	83-96	0	0-.2	0	4-17
2. Alternate bearing tree, in *off* year..	2-6	2-8	16-28	59-73	3-9	6-18
3. Annual bearing tree (McIntosh)..	1-5	31-34	6-11	29-34	2-3	3-18

To secure annual fruiting it becomes necessary to stimulate the growth of the tree *in the off year* so that a considerable percentage of spurs which would normally produce fruit buds in that season will be forced into categories 5 and 6. Spur behaviour will then tabulate as follows:—

TABLE No. 2.

CLASS	1 mm. 1-2	2 mm. 1-3	3 mm. 3-4	4 mm. 4-9	5 mm. 10-200	6 mm. 10-500
1. Starting with (on year)..	2-3	83-96	0	0-.2	0	4-17
2. Stimulated (by pruning) off year..	1-3	1-4	7-11	18-49	4-6	21-44
3. Next year (estimated)..	....	30-40	....	30-40	....	....
4. Result is annual fruiting..	....	30-40	....	30-40	..	.

We thus get a tree with two sets of spurs, each set of which produces fruit in alternate years. Our experiments show that this result cannot be accomplished by thinning of the fruit but that it can be accomplished by moderate heading back of small branches *in the off year*. Our experiments show that it can also be accomplished by stimulating the growth of the tree with Nitrate of Soda *in the off year*. The Nitrate requires to be applied very early in the spring for the reason that the large majority of fruit spurs have a very short period of growth (from 4 to 10 days). Our observations lead us to believe that 75 per cent or more of the fruit spurs on Duchess and Wealthy have completed their growth for the season *by the time the first blossoms have well set on blooming trees of the same varieties.* Experiments in bud and blossom removal indicate that the date given is certainly the critical period of fruit bud formation for trees *in their on year.* Table 3 shows 79 per cent of fruit bud formation from spurs disbudded before that time and none whatever from spurs disbudded after that time. We suspect that no treatment can be applied after that time which will change the destiny of buds falling in categories 1, 2, 3 and 4 on either bearing or non-bearing trees.

TABLE 3.—BLOSSOMING AS RELATED TO FRUIT BUD FORMATION.

Duchess Tree, Twenty-five Years of Age.

Dates of Blossom Cluster Removal.	Branch No.	1919 Growth. Strong Fruit Spurs.	Long Fruit Growths.	Types of Growths Developed, 1920. Short Leaf Spurs.	Long Leaf Growth.	Weak Fruit Spurs.	Strong Fruit Spurs.	Long Fruit Spurs.
15-5-20	1a	125	7	3	0	17	101	4
18-5-20	11a	110	8	5	0	21	83	4
19-5-20	12a	91	6	2	1	11	76	4
20-5-20	12b	121	12	7	0	16	89	3
21-5-20	1b	155	9	19	6	12	116	8
22-5-20 (First Blossoms Opened)	2	327	24	46	2	43	263	7
23-5-20	3	112	11	7	14	15	89	9
24-5-20	1c	130	8	6	0	19	98	13
25-5-20 (Full Bloom)	1d	302	15	28	9	61	231	11
26-5-20	11b	404	36	36	21	72	315	31
27-5-20	10a	129	16	43	7	17	81	9
28-5-20 (First Petals Falling)	10b	124	13	117	13	3	14	6
29-5-20 (Fruit well set)	5a	117	5	110	27	13	2	0
Critical period	Total	2,247	170	429	100	320	1,558	109
31-5-20	9	118	13	128	31	0	0	0
2-6-20	7a	122	10	143	13	0	0	0
5-6-20	7b	105	7	116	18	0	0	0
8-6-20	4a	110	6	123	11	0	0	0
21-6-20	6	185	12	199	16	0	0	0
Check	4b	209	11	236	17	0	0	0
Check	5b	188	9	210	14	0	0	0
Check	8	337	22	384	32	0	0	0
Total		1.374	90	1,539	152	0	0	0

MARKETING.

W. A. BROWN, M.S., B.S.A., Chief, Poultry Division, Live Stock Branch, Ottawa.

(Extract from address delivered to Eastern Ontario Branch of C. S. T. A., Ottawa, December 11,1920).

The lack of business methods in the marketing of farm products has been one of the greatest drawbacks to the progress of Canadian agriculture. Much of the compensation due producers has been lost through inefficiency in marketing. Farmers, as a class, gained a reputation for petty dickering but until recently have failed in the larger issues of business practice.

There have been two kinds of losses:—

(a) **Monetary.**—In the sale of his products the farmer has been legitimate prey for all and sundry. Rarely has he been able to sell anything to advantage. Except where he has direct access to large consuming markets he has been obliged to take what was offered by the first buyer or handler in an almost endless chain of dealers between him and the consumer. Through lack of direct sale, through failure to take advantage of the best markets, through lack of direct connection with large export centres, through the keen competition of his fellows engaged in producing the same lines and without proper facilities for the collection and marketing of the products in carlots and larger quantities, millions, yes, billions of dollars have been lost to the producer.

(b) **Morale.**—Through lack of knowledge of the markets and inability to market to advantage, and seeing others profit by their lack of knowledge, many producers in the past have become indifferent and dissatisfied. Their homes, their farms, have reflected their state of mind. It is not surprising that the young people on the farm, surrounded by this atmosphere and environment, have left the farm and sought employment and scope for their talents elsewhere.

What is the remedy? From actual experience it would appear that the farmers of Denmark, the fruit growers of California and the grain growers of the Canadian west have found the remedy; viz., the introduction of co-operative marketing in its broadest sense and the application of business principles in the handling and sale of the product. There is no bigger business than the business of agriculture; no business responds more effectively to the application of business principles and business common sense. Viewed from a wide angle, the business of agriculture offers to the young man and woman on the farm every inducement that the large departmental store, the factory or the counting house can offer. What is needed in Canadian agriculture is a larger interpretation by the individual of Canadian ideals, Canadian opportunities, and a keener realization of the place of agriculture in the business of the nation.

Breeders' Column

Agricultural Production in the Province of Quebec
Production Agricole dans La Province de Québec

COMPARISON BETWEEN 1911 AND 1920—COMPARAISON ENTRE 1911 ET 1920

Field Crops—Récoltes des Champs

	1911 Superficie ensemencée Area seeded acres	1911 Production Yield boisseaux bushels	1911 Valeur Value	1920 Superficie ensemencée Area seeded acres	1920 Production Yield boisseaux bushels	1920 Valeur Value
Blé Wheat	68,999	1,223,000	$ 1,443,000	222,045	4,163,000	$ 8,456,000
Avoine Oats	1,430,209	37,500,000	19,875,000	2,205,908	66,729,000	58,722,000
Seigle Rye	12,735	200,000	202,000	28,462	534,000	1,004,000
Orge Barley	99,762	2,271,000	1,771,000	194,444	4,910,000	6,923,000
Pois Peas	32,507	517,000	708,000	60,870	1,035,000	3,478,000
Fèves Beans	6,065	114,000	225,000	35,835	645,000	2,632,000
Sarrasin Buckwheat	112,880	2,548,000	1,886,000	151,765	390,800	5,393,000
Grains mélangés Mixed grains	114,347	2,925,000	2,018,000	143,423	4,195,000	5,286,000
Lin Flax	1,146	13,000	22,000	16,035	184,000	657,000
Maïs à grains Corn for husking	23,473	712,000	719,000	47,741	1,420,000	2,258,000
Pommes de terre Potatoes	124,381	15,763,000	10,561,000	310,692	57,633,000	57,633,000
Plantes-racines Roots	13,543	3,943,000	1,459,000	83,613	27,530,000	13,765,000
		Tonnes Tons			Tonnes Tons	
Foin et trèfle Hay and Clover	3,294,230	6,260,000	63,664,000	4,290,121	5,363,000	155,527,000
Maïs fourrager Fodder Corn	37,155	325,000	1,560,000	86,833	695,000	7,089,000
Luzerne Alfalfa	3,634	14,000	135,000	28,200	68,000	1,428,000
		lbs			lbs	
Tabac Tobacco	12,094	10,095,901		33,000	26,400,000	6,600,000

Total area seeded in 1911 .... 5,480,673 acres .... Superficie totale ensemencée en 1911
— — — in 1920 .... 7,905,987 acres — — — en 1920
Total value of field crops ...... $ 65,353,528 .... 1911 ...... Valeur totale de la récolte
— — 330,251,000 .... 1920 ...... — — — —

Province of Quebec—Province de Québec

Dairy Industry—Industrie Laitière

	1911	1920
Butter Beurre	41,782,678 lbs valued at $9,961,732	37,681,366 lbs valued at $20,857,523
Cheese Fromage	58,171,091 lbs valued at $5,695,254	58,044,719 lbs valued at $15,305,488

The Department of Agriculture of Quebec maintains forty-three District Representative offices.

La Revue Agronomique Canadienne

Section Française de l'Organe Officiel

DE LA

Société des Agronomes Canadiens

REDACTEUR, F. LETOURNEAU

Notre Société

L'agriculture, écrit Jouzier, a fait par la science, au cours du 19e siècle, de plus grand progrès qu'elle n'avait plus en faire au cours de vingt siècles de pure tradition. Si le sol, moyennant moins de peine pour ceux qui le cultivent, pourvoit beaucoup mieux qu'il y a cent ans aux besoins d'une population moitié plus nombreuse et combien plus exigeante, nous le devons, sans doute, à plus d'expérience chez le cultivateur, mais plus encore à l'utilisation de la vapeur comme force motrice, qui a plus que centuplé la puissance de notre outillage; aux progrès de la chimie et la biologie, qui ont abouti à un immense perfectionnement de nos plantes et de nos animaux et de nos moyens d'exploitation eux-mêmes; nous le devons surtout à ce que les savants travaillent sans relâche à reculer les limites de l'inconnu, et à ce que nous vivons le siècle par excellence de la vulgarisation scientifique.

Et cependant que d'obscurité encore pour les plus éclairés! Que nous sommes loin du jour où le travailleur des champs saura se laisser guider passivement par ceux qui savent, ou connaîtra lui-même les forces les plus secrètes de la nature, qu'il exploite, assez pour être son propre guide et savoir les dévier vraiment à son profit plutôt que d'y heurter son impuissance! Que nous sommes éloignés enfin du jour s'il doit luire jamais, où tous les hommes sauront comprendre qu'ils ne doivent être les uns pour les autres que de loyaux collaborateurs dans l'assaut à donner aux forces naturelles, où tous ils sauront comprendre que leur salut est là et faire leur devoir.

Reculer les limites de l'inconnu, vulgariser la science agricole, guider, dans ses travaux, l'homme des champs, tel est, en résumé, le programme que s'est tracé la société des agronomes canadiens. Elle s'efforcera de mettre en pratique les idées exprimées par le professeur Jouzier. Elle servira l'agriculture et, partant, tout le pays.

L'idée de cette organisation fut lancée au mois d'août 1919 au Collège Macdonald. Un comité, composé de MM. F.-E. Buck, M.-B. Davis, F.-L. Drayton, F.-H. Grindley et G. LeLacheur, y travailla sans relâche pendant tout près d'un an. L'oeuvre fut complétée à la convention du mois de juin dernier. Elle n'a fait depuis que grandir. La Société compte actuellement plus de 500 membres. Elle poursuivra son but, qui est

De coordonner les travaux des techniciens agricoles de notre pays;

De relever le niveau de la profession agricole et de maintenir sa dignité;

D'encourager une politique nationale de recherches scientifiques agricoles;

De concourir à l'obtention des fonds nécessaires au développement et à la vulgarisation de la science agricole;

D'établir une coordination plus étroite entre les différentes associations agricoles du pays;

De voir à ce que les positions officielles ne soient remplies que par des hommes compétents;

De soumettre à la discussion ce qui a trait à l'enseignement de l'agriculture, aux travaux de recherches, de propagandes et de publicité agricoles;

De coordonner les travaux des ministères fédéral et provinciaux de l'agriculture, des collèges agricoles et des sociétés techniques.

Les membres de la Société se divisent en deux catégories: réguliers et honoraires.

Il faut, pour devenir membres réguliers:

(a) Etre gradué en science agricole d'une université ou d'un collège reconnu;

(b) Etre gradué d'une université et s'occuper de travaux de recherches, d'expérimentation, d'administration, d'enseignement ou de publicité agricoles;

(c) Etre employé, bien que ne possédant aucun titre, dans les différents travaux agricoles mentionnés dans la classe b.

Dans ce dernier cas, un comité spécial étudie les demandes d'admission des aspirants.

La catégorie des membres honoraires se compose de toute personne éligible comme membre régulier et qui a rendu à la profession agricole des services signalés.

La Société comence aujourd'hui la publication de son organe officiel. Il propagera la science, principal facteur de la production agricole. Qui aime l'agriculture s'y abonne.

F. LETOURNEAU.

L'agriculture, dont les problèmes multiples et difficiles offrent un champ si vaste à tous ceux qui travaillent à son avancement, s'est assurée une force nouvelle par la création de la Société des agronomes canadiens. Les membres de cette Société, convergent tous vers un même but se sont unis par une association puissante dont la Constitution tend à promouvoir l'avancement scientifique et pratique de l'agriculture par la coordination des efforts de tous: le travail qu'elle présente à ses membres est immense et ne peut s'accomplir que par l'union des forces de ceux qui sont appelés à diriger cette marche progressive de l'agriculture dans notre pays.

Cette création qui constitue une union synonime de force s'imposait. Elle est appelée non seulement à sauvegarder les intérêts de la classe agricole, mais aussi à établir des liens d'amitié qui doivent unir ceux

qui travaillent pour une même cause. Formée d'une élite, la S. A. C. recrute ses membres par tout le Dominion; l'esprit d'entente qui l'anime est un gage assuré de survivance et de succès. L'élément canadien-français qui en fait partie intégrante saura se faire mieux connaître pour se faire apprécier davantage. Dans la poursuite d'un même travail, les échanges d'idées, les discussions amicales au cours des réunions générales de tous les membres, produiront des effets qui se feront ressentir sur toutes les classes de la société. L'influence que, comme corps scientifique la Société est appelée à exercer aidera à solutionner les grands problèmes qui s'offrent actuellement à l'étude de la classe agricole.

Elle rendra à la classe agricole le rang que celle-ci mérite en s'efforçant de faire disparaître les opinions d'infériorité manifestées à son égard par un trop grand nombre.

Chaque membre est appelé à fournir sa part de travail, à mettre ses connaissances au service de la Société, phare lumineux d'où jailliront les lumières qui guideront le travailleur du sol dans son oeuvre patriotique et nationale.

JULES SIMARD.

LA SOCIETE DES AGRONOMES CANADIENS DANS LE QUEBEC

La Société des Agronomes Canadiens a mis en pratique le principe de la décentralisation. Ses membres se groupent d'abord en Sections locales, celles-ci en branches provinciales, lesquelles se rattachent au Conseil exécutif national, le pivot de la Société.

Celui-ci fut organisé en premier lieu. C'est sous sa direction qu'eut lieu la grande convention d'organisation du mois de juin dernier. Nous donnons aujourd'hui quelques-uns des travaux qui y furent présentés.

Le Conseil exécutif national ou fédéral se compose de MM. L.-S. Klinck, de l'Université de Vancouver, président; H. Barton, professeur au Collège Macdonald et J.-N. Ponton, rédacteur du Bulletin des Agriculteurs, vice-présidents; L.-H. Newman, du Service fédéral des semences, secrétaire honoraire, et d'un représentant de chaque province. M. Jules Simard est le délégué du Québec.

Dr. A. T. CHARRON,
President de l'Executif Provincial.

Le Conseil exécutif de la Branche provinciale du Québec se compose de MM. A.-T. Charron, directeur de l'Ecole de Laiterie de Saint-Hyacinthe, président; R. Summerby, professeur au Collège Macdonald, vice-président; Jules Simard, du Service fédéral des semences, secrétaire.

Le Conseil exécutif provincial dirige, dans le Québec, trois sections locales, comptant chacune environ 50 membres: la Section du Collège Macdonald, la Section de Québec et la Section de Montréal.

La Section du Collège Macdonald est anglaise. Son exécutif se compose de MM. R. Summerby, président; B.-T. Dickson, vice-président; L.-C. Raymond, secrétaire-trésorier.

Les Sections de Québec et de Montréal sont françaises.

La Section de Québec, qui recrute ses membres dans le territoire de la province situé à l'Est de Trois-Rivières, a été organisée en septembre dernier. Une assemblée avait été, à cet effet, convoquée par M. Jules Simard.

L'exécutif ou le Bureau de direction de la Section de Québec se compose de M. Jules Simard, président; de M. N. Savoie, secrétaire du Ministère de l'Agriculture et directeur des Agronomes, vice-président, et de M. L.-P. Roy, chef du Service de la Grande Culture, secrétaire.

C'est au cours de cette assemblée que M. L.-D. McClintock, agronome officiel, proposa d'organiser les techniciens agricoles anglais et français de la province en Sections distinctes.

La Section de Montréal fut organisée en octobre dernier. Le Dr A.-T. Charron en est le président, J.-E. Montreuil, le vice-président, M. F. Létourneau, le secrétaire.

Le 3 décembre, à Québec, à la clôture du congrès des Agronomes, sous la présidence du Dr. Charron, les sections françaises du Québec tinrent une assemblée conjointe.

On adopta, entre autres choses, les trois propositions suivantes:

Que, vu l'actualité et l'opportunité de l'étude d'un système complet d'enseignement agricole dans la province et vu la multiplicité des opinions exprimées à ce sujet, un comité soit chargé de soumettre à l'hon. Ministre de l'Agriculture le voeu émis par les membres de la Société des Agronomes Canadiens, Sections françaises, réunis en assemblée générale à Québec, le 3 décembre 1920 à savoir: l'étude par les autorités techniques agricoles et pédagogiques de la province d'un système complet d'enseignement agricole qui serait discuté à un congrès convoqué à cette fin par la Société en vue d'établir un programme nettement défini pour le développement futur de l'enseignement agricole à ses différents degrés.

Que la Société regrette la concurrence malheureuse que se font les coopératives existantes dans la province et considère qu'il est opportun de favoriser l'unification de ces coopératives afin d'obtenir un organisme de véritable coopération.

Que la Société exprime le voeu que tous les organismes agricoles et tous les hommes publics s'appliquent à renseigner la classe agricole sur le sens et l'importance du prochain recensement fédéral, afin d'établir avec précision l'état de l'agriculture du Québec.

La Vulgarisation de la Science Agricole au Canada

Par G.-A. PUTNAM, du Département de l'Agriculture
de l'Ontario.

La place que nous donnons à la vulgarisation de la science agricole dans le programme de la première réunion des agronomes canadiens prouvera au public, je l'espère, toute l'importance que nous attachons à cette question comparée aux autres efforts faits dans l'intérêt de l'agriculture.

Le travail de vulgarisation, tel que je l'entends, embrasse tous les moyens par lesquels la science agricole est mise à la portée du cultivateur, de sa famille, chez lui, pour tout ce qui concerne la production, les affaires, enfin tous les problèmes d'une exploitation agricole. Ces moyens signifient: publicité, conférences, démonstrations, discussions, illustrations, expériences.

En agriculture, les recherches scientifiques, les travaux d'expérimentations n'ont leur pleine valeur qu'en autant et dans la mesure que les résultats en sont vulgarisés parmi la classe agricole. J'ai le regret de dire que jusqu'ici, au Canada, nous ne nous sommes pas assez occupés de la vulgarisation de la science agricole: nos efforts dans ce sens ont été plutôt spasmodiques, sans aucun plan défini, sans aucune forme déterminées. C'est un fait que la science agricole, par ses recherches, ses expériences, ses méthodes, son enseignement —démonstrations, conférences, illustrations—est bien en avant de la pratique, et il me paraît sage, urgent même, d'adopter une politique nouvelle par laquelle une plus grande somme de travail, de temps et d'argent sera appliquée à la diffusion de la science agricole de manière à en rendre les données, certaines ou en voie de le devenir, plus généralement connues. La plupart d'entre nous peuvent ignorer ce qui n'est pas encore parfaitement défini, jusqu'à ce que la lumière se fasse sur ces incertitudes.

G.-H. PUTNAM.

Vous me permettrez bien de faire, à ce sujet, une suggestion que je soumets très volontiers à votre discussion. Je ne veux en aucune manière atténuer l'importance du travail expérimental ou de recherche, ni celle de l'instruction donnée aux étudiants réguliers dans nos collèges ou écoles d'agriculture, mais je veux, cependant, exprimer ma conviction que les meilleurs intérêts de l'agriculture, en autant que les résultats immédiats et l'avenir de cette industrie sont en jeu, pourraient être mieux servis si une partie plus considérable des fonds disponibles était employée à activer une campagne générale dont le but serait de procurer à tous les cultivateurs du Dominion au moins l'essence des conclusions auxquelles est arrivée la science agricole, tant au point de vue expérimental que pratique. Bien que nous ayions encore beaucoup à attendre des nouvelles recherches, des travaux d'expérimentation, des études en cours, l'essentiel, à mon sens, le devoir de l'heure présente, pour tous ceux qui poursuivent un si important travail, serait de mettre devant le public agricole ce qui s'est accompli dans les conditions ordinaires de culture et le convaincre qu'il y a encore des méthodes supérieures à celles employées jusqu'ici. Puis, au moyen de démonstrations, de conférences, d'exemples, on pourrait donner les renseignements voulus pour expliquer ces méthodes là où les conditions locales le permettent.

L'importance du travail éducationnel fait par nos collèges agricoles n'a été apprécié par le cultivateur que lorsque des instructeurs, des conférenciers sont venus lui révéler le résultat des expériences faites, des succès obtenus par ceux qui avaient donné dans cette voie de progrès. Ce système avait un double avantage: non-seulement il présentait le travail fait sous son véritable aspect, mais il permettait en outre aux directeurs des stations expérimentales ainsi qu'aux professeurs de modifier leur programme d'études de manière à mieux rencontrer les besoins des cultivateurs. L'exacte appréciation de l'importance de la publicité des démonstrations a doté les Etats-Unis d'un réseau de départements dont la mission est précisément de vulgariser la science agricole. Il n'y a, en ce moment, que treize Etats qui ont des Associations agricoles indépendantes de Collèges d'Agriculture. Trente-cinq états ont des fonctionnaires spéciaux dans les collèges d'agriculture qui en dirigent le travail, et tous les Etats ont un service spécial de vulgarisation.

Il serait trop long de passer en revue les diverses méthodes, et dans une large mesure, les tentatives avortées qui ont caractérisé le travail de vulgarisation au Canada. Je ne citerai que quelques exemples fournies par Ontario et que je connais très bien. Ontario a été la première province à adopter ce que, dans le temps, nous croyions être une politique avancée en agriculture.

En voyageant à travers cette province, il est vraiment agréable d'apprendre de tel et tel cultivateur, regardé comme un chef agricole dans sa division, qu'il conçut le projet de rompre avec la routine, de faire siennes les méthodes nouvelles, d'idéaliser en quelque sorte son travail, après avoir entendu des conférences données par des maîtres en agriculture au cours des dernières cinquante années. Ces conférenciers étaient soit des fermiers de progrès, soit des professeurs, soit des instructeurs nommés tant pour le gouvernement fédéral que par le gouvernement provincial. Certain cultivateur attribue même son succès à la lecture de quelques articles de revues agricoles qui ont été pour lui comme une révélation. Reconnaissons le travail considérable, accompli pendant cette première période, alors que la science agricole dépendant presque exclusivement au début des Cercles agricoles, de la presse et des publications officielles.

Dans l'Ontario, et cela peut être également dit d'autres provinces, il n'y a pas eu la cohésion, la coopération des diverses forces nécessaires pour donner aux efforts faits l'efficacité désirée. Pour faire un travail efficace, il faut, de toute nécessité, un système d'opéra-

tion large et bien défini, qui réunissent tous les intérêts fédéraux, provinciaux ou inter-provinciaux. J'ai confiance que l'un des résultats de cette Conférence sera la formation d'un Comité puissant, chargé d'étudier la création d'une politique d'union qui permettrait aux cultivateurs de progrès, aux fonctionnaires du gouvernement (professeurs, expérimentateurs, instructeurs, etc.) aux représentants de la presse agricole, aux marchands, aux hommes d'affaires, de jeter les bases d'une politique agricole dont le but sera de stimuler, de développer l'agriculture dans un pays de ressources aussi considérables que le nôtre.

Pour ce qui est du personnel, de la matière, de la méthode, de la vulgarisation de la science agricole, le champ d'action est illimité.

Le Personnel

Il ne comprend pas seulement les professeurs, les instructeurs, les chefs de démonstration dans les Collèges d'Agriculture et les Fermes Expérimentales, mais il se compose aussi d'une petite armée de travailleurs dont les chefs sont les agronomes ou officiers du département de l'agriculture. Il ne faut pas perdre de vue que les cultivateurs ordinaires, qui ont à faire face, chaque jour, aux divers problèmes agricoles, sont d'importants facteurs dans ce travail de vulgarisation. Le personnel de cette branche devra comprendre un bon nombre de praticiens avisés, au courant des améliorations et méthodes modernes, des récentes expériences. Les cultivateurs du Canada ont fait de grands progrès, et le conférencier qui entreprend de vulgariser la science doit être en état de donner non-seulement des généralités, mais encore une foule de détails et parfois le dernier mot sur les sujets qu'il traite. Comme dans la plupart des collèges d'agriculture il est pratiquement impossible aux professeurs ainsi qu'aux directeurs des stations expérimentales de consacrer beaucoup de temps à la préparation de ce champ d'action, il est désirable que les autorités voient à donner à ceux qui sont chargés de l'enseignement théorique et démonstratif un temps raisonnable pour qu'ils se renseignent sur la manière de faire des cultivateurs, étudient leur méthode, le point de vue auquel ils se placent dans la ligne qu'ils exploitent. Il doit y avoir un lien très étroit entre l'enseignement, la démonstration et l'action des cultivateurs; c'est par ce moyen qu'on peut arriver à des résultats vraiment pratiques.

Ceux donc qui veulent se lancer dans cette sphère d'action doivent conférer ensemble, échanger leurs idées, déterminer les points particuliers sur lesquels il importe d'appuyer, discuter les moyens à prendre et les illustrations à faire, etc.

Le Programme

Il y a certainement une foule de connaissances de la plus haute importance que la masse des cultivateurs ne possède pas, des procédés de culture, des principes fondamentaux indiscutables que, dans le public agricole, on n'admet pas ou dont on n'apprécie pas la valeur; c'est pourquoi, notre programme doit surtout viser à ce qui est pratique et à la mise en lumière des principes fondamentaux, présentés de façon à éclairer les cultivateurs et leur inspirer la confiance. Il y a les grandes règles de culture, la question de propreté ordinaire dans la production et la manipulation du beurre et du fromage, la valeur du reproducteur de race pure, la sélection des grains de semence et beaucoup d'autres items primoriaux dont on n'a pas encore épuisé la matière d'enseignement dans notre oeuvre de propagande. La difficulté n'est pas de trouver la matière des sujets à traiter, mais bien à faire un choix judicieux de ces sujets et les adapter aux besoins particuliers des gens auxquels on s'adresse. Sans doute on doit mettre en avant le besoin d'une production plus grande, mais on doit surtout appuyer sur une production payante. Il appartient aux gouvernements de suggérer ce qu'il faut faire, mais c'est aux gens à exécuter.

Méthode à suivre

Le conférencier doit choisir son temps et son lieu, mais dans la plupart des cas, notre oeuvre de propagande ne sera efficace qu'en autant que le matériel d'illustration employé sera approprié; des cartes, des vues stéréoscopiques ou cinématographiques, des modèles de construction et d'équipement, des échantillons de produits peuvent servir à l'occasion et être d'une grande utilité. Les Cercles de Fermières d'Ecosse, qui se sont presque calqués sur les méthodes ontariennes ont introduit dans leur programme un système qui est très effectif. Ces dames s'efforcent d'avoir à chacune de leurs réunions non seulement quelque chose à entendre, mais aussi quelque chose à voir, et même, si possible, quelque chose à faire pour chaque personne présente. Si nous pouvions organiser nos assemblées de telle sorte que la science pût entrer par les yeux en même temps que par les oreilles, et les impressions rendus encore plus vives par la part que chacun prendrait aux travaux et aux expériences, je suis convaincu que notre travail serait triplement efficace. Nous possédons déjà un matériel d'illustration qui, sous forme de statistiques, de rapports, de tenue de livres types, desseins, photographies, vues animées, propre à chaque province agricole. Partout où l'occasion s'offre au producteur de comparer ses produits avec ce qu'il y a de mieux dans son district, son comté ou sa province, la comparaison rend l'impression plus vive. Les instructeurs devraient s'entendre avec les cultivateurs pour adopter un plan efficace de vulgarisation.

J'espère que je ne laisse personne sous l'impression que le salut de l'agriculteur dépend exclusivement de la qualité ou de la quantité des publications, de la valeur des renseignements fournis par les conférenciers, par les démonstrations ou encore par l'exactitude pratique des expériences. Ce sont là des facteurs très importants si l'on veut, mais l'essentiel dans tout progrès consiste à diriger les gens, à les encourager et à les engager à se tirer d'affaires eux-mêmes. Le plus grand service que l'on puisse rendre aux cultivateurs et aux colons, c'est de seconder ses initiatives, de l'aider à tirer le meilleur parti possible de ses talents et de ses ressources, de lui inculquer l'idée d'une coopération active avec ses concitoyens. Il faut encourager les cultivateurs à discuter leurs problèmes d'abord selon leur manière de voir.

Dans Ontario, comme dans les autres provinces, nous avons maintenant des organisations locales: Cercles agricoles, Associations de fermiers, Clubs de jeunes filles, de jeunes garçons, Cercles coopératifs de jeunes fermiers, etc. Par une direction convenable de la part des directeurs de ces organisations, tant fédéraux que locaux, on rendrait le travail extérieur des départements beaucoup plus effectif.

Voulons-nous réussir dans une telle entreprise, il faut avoir des organisations locales permanentes, sous le contrôle d'une organisation régionale centrale.

Il y a sans doute un très grand avantage à tenir çà

et là des assemblées agricoles générales auxquelles des orateurs qualifiés, parfaitement au fait des données scientifiques et des méthodes suivies, porteraient la parole et feraient naître l'intérêt et l'enthousiasme nécessaires pour stimuler l'effort individuel; mais, à mon sens, la majeure partie du travail devrait consister naturellement à répondre aux demandes des organisations locales qui ont étudié leurs problèmes particuliers à leur point de vue, et qui sentent le besoin d'être assistés, de recevoir les conseils de ceux qui sont réputés des experts dans les questions qui seront soumie à leur considération.

Inventaire et Etude des Sols

Prof. H.-M. NAGANT, Institut Agricole d'Oka.

Importance de la question

Il y a longtemps déjà qu'on s'est occupé, dans tous les pays à organisation économique un peu avancée, de dresser l'inventaire des ressources de chacune des branches de l'agriculture, considérées en particulier. Bien souvent aussi des études détaillées de tous les facteurs exerçant leur influence sur la production ont été faites. C'est ainsi que dans notre province on sait assez bien quels sont les rendements respectifs des céréales, des plantes-racines, des cultures fourragères. Les statistiques nous donnent également une assez bonne idée de la valeur en piastres que représentent les produits de l'horticulture, de l'aviculture, de la culture du tabac, etc. Pour terminer cette énumération d'exemples par la branche principale de notre propriété agricole, notons encore qu'on a fait depuis longtemps le dénombrement des vaches laitières, des quantités de lait produites en moyenne et de celles obtenues des meilleurs sujets. On a aussi calculé la valeur totale des produits laitiers. Ces données sont très utiles, d'abord parce qu'elles nous renseignent sur l'importance relative des sources de richesse agricole, ensuite parce qu'elles nous suggèrent tout naturellement la recherche des moyens d'augmenter le rendement de ces sources par le perfectionnement de tous les facteurs exerçant quelque influnce. Ainsi n'est-il pas extrêmement intéressant et utile de savoir quel est dans la province de Québec la production du troupeau laitier et d'étudier en détails quelles sont les diverses conditions ou circonstances qui influent sur cette production. Sachant que la valeur globale des produits de la laiterie représente annuellement un revenue de $60,000,000, pour notre province, on en déduit immédiatement qu'un perfectionnement de 10 pour cent seulement dans le rendement moyen par animal se traduira par une augmentation de richesses égale à $6,000,000 par an. Ce seul fait sera suffisant pour justifier les plus grands efforts tendant à l'amélioration de notre troupeau par la reproduction, l'alimentation, le contrôle laitier, etc. Si ce que nous venons de dire est vrai, appliqué à chacune des branches de l'exploitation agricole considérées séparément, l'établissement d'un inventaire, l'étude détaillée des ressources du fondement même de l'agriculture, du sol arable, ce grand réservoir auquel s'alimentent en définitive, quelle que soit leur importance, toutes les branches de la production agricole, n'ont-ils pas une importance plus grande encore?

Et pourtant il faut convenir que, jusque il y a peu d'années, on n'a guère entrepris grand'chose en fait d'étude méthodique des ressources agrologiques dans la plupart des pays en général. Aujourd'hui même on peut encore dire que nous ne possédons pas de données réellement scientifiques concernant les terres cultivées ou cultivables que renferment les trois grandes régions physiographiques occupant le territoire de la province de Québec. Les différents types de sols qu'on y rencontre n'ont encore guère été étudiés dans un but agricole; à plus forte raison ne connait-on pas leurs étendues respectives ni leur délimitation. Mais il faut dire aussi que l'établissement d'un inventaire et l'étude approfondie des ressources agrologiques d'un pays constitue une oeuvre de longue haleine, demandant une organisation complète, la collaboration d'une équipe d'experts exerçant chacun leur spécialité. Elle ne peut fournir des résultats tangibles qu'au bout d'un certain nombre d'années.

L'Etude des sols aux Etats-Unis

Depuis quinze ou vingt ans on s'est rendu compte aux Etats-Unis de l'importance capitale de cette oeuvre pour l'avancement de l'agriculture scientifique. Beaucoup d'Etats de l'Union américaine ont créé un service complet pour l'étude des sols et de tous les problèmes relatifs à la conservation et l'augmentation de leur fertilité, basé sur une collaboration étroite et méthodique entre les enseignements de la géologie, le laboratoire de chimie et les parcelles d'expérimentation culturales. Ceci indépendamment de l'organisation centrale visant l'étude des sols et matières fertilisantes, connue sous le nom de "Bureau of Soils", lequel a son siège à Washington, et s'occupe du même sujet dans toute l'étendue du territoire américain. Les études géologiques fournissent les données pour l'établissement des cartes agrologiques des régions soumises aux investigations. Les laboratoires font l'analyse physique et chimique des échantillons les plus représentatifs prélevés dans les divers types de sols ou sous-sols reconnus. Ces analyses nous apprennent quelles sont, en moyenne, les réserves de matériaux nutritifs: azote, acide phosphorique, potasse, etc., que chacun d'eux tient en réserve. Mais ceci ne suffit pas, car ainsi que le fait remarquer le Dr. Kedsie, en commentant une étude sur les sols du Michigan: l'analyse chimique a de la valeur pour déterminer si un sol est susceptible de fertilité, mais elle ne peut pas toujours distinguer entre un sol productif et un sol improductif. Une terre peut être infertile pour des raisons physiques tout en renfermant de grandes quantités d'éléments chimiques de fertilité. C'est pourquoi le travail de laboratoire doit être complété par un système méthodique de parcelles d'expérimentations. Ces parcelles servent évidemment en premier lieu à vérifier les résultats de l'analyse relativement au besoin d'ajouter les éléments dont l'insuffisance première est une cause de limitation des rendements; mais en outre elles doivent montrer quelle est l'assimilabilité relative des principes existant en quantités considérables, quels sont les amendements physiques, chimiques ou biologiques nécessaires pour augmenter cette assimilabilité relative, et enfin quel est le résultat économique des divers modes de traitement appliqués à un sol donné, pour en augmenter le rendement.

L'Etude des sols dans l'Illinois

Parmi les Etats qui ont le mieux organisé l'étude des ressources agrologiques, on pourrait mentionner l'Illinois, l'un des principaux de l'Union quant à l'importance agricole.

Pour donner une faible idée du travail qui s'accomplit dans ce sens, extrayons les points suivants tirés d'un bulletin publié en 1916 par la station agricole expérimentale de l'Université de l'Illinois, sous la signature du Dr. Cyril Hopkins de Y.-G. Mosier, et F.-C. Bauer, intitulé: "Summary of Illinois Soil Investigations."

Les auteurs commencent par nous apprendre que la station de l'Illinois inaugura ses recherches, relatives aux sols, en 1901, avec un crédit de $10,000, par an, accordé pour deux années. La valeur du travail accompli apparut bientôt si évidente que l'appropriation fut portée à près de dix fois le premier montant, annuellement, à l'époque où parut ce Bulletin.

Ensuite est exposé:

Le but assigné aux recherches

Ce but peut se résumer à prendre connaissance des cinq points suivants nécessaires à l'exploitation rationnelle des sols de l'Illinois: 1. Des exigences en éléments nutritifs des récoltes à produire.

2. Du stock ou réserve totale en éléments essentiels contenus dans les différentes catégories de sols.

3. Du degré d'assimilabilité des aliments de la plante, par les moyens pratiques de culture.

4. Des méthodes les plus rationnelles et les plus économiques pour maintenir et augmenter le stock d'éléments nutritifs du sol.

5. De rechercher les systèmes de culture maintenant de la manière la plus avantageuse et de façon permanente la capacité productive du sol.

L'étude de tous ces points est rendue possible par la classification des sols, leur analyse chimique et les expériences de culture.

Classification des sols de l'Illinois

Ce travail constitue la première partie de l'oeuvre à accomplir. C'est ainsi que les études de la géologie superficielle des régions agricoles de l'Illinois a permis de distinguer quatorze régions agrologiques bien définies, lesquelles sont indiquées en quatorze teintes différentes sur la carte agrologique dont est accompagné le bulletin en question. On nous dit encore que dans les comtés couverts par les dix premiers rapports, soixante-deux types distincts de terrains furent identifiés. Ces types peuvent être très variables, mais au point de vue pratique on les a groupés en six classes comprenant: les sols de prairies élevées, les sols forestiers élevés, les sols de terrasse, les sols de crêtes d'élévation et dépôts morainiques, les terres de savane et de bas-fonds, les sols résiduels.

Suit une discussion des caractères généraux des principales catégories de sols, décrits en détails dans les rapports séparés qui leur ont été consacrés.

Analyse chimique

La classification et l'identification des sols d'un comté étant faite, il est procédé avec soin à la prise d'échantillons moyens bien représentatifs de chaque type de sol dont la présence est reconnue. Lorsqu'un type existe sur des étendues considérables, on prélève un grand nombre d'échantillons. Un poids d'environ dix livres, de chaque échantillon rendu parfaitement homogène, est alors mis dans un sac, muni d'un numéro d'ordre pour être expédié au laboratoire de la station expérimentale d'Urbana où il est soumis à une analyse comportant neuf déterminations différentes, dont les principales sont: la réaction, c'est-à-dire examen pour rechercher si le sol est acide, neutre ou alcalin, la contenance en carbonate de chaux, le pourcentage en matière organique, en azote total, en phosphore, en potassium, en calcium, en magnésium. Le reste de l'échantillon est ensuite serré soigneusement dans une voûte afin de pouvoir faire éventuellement, plus tard, de nouvelles déterminations en tout comparables avec les premières, si la chose était jugée utile. Pour faciliter les comparaisons dans les applications pratiques, tous les pourcentages en éléments fertilisants, contenus dans la partie superficielle de la couche arable, sont ensuite rapportés à un poids de deux millions de livres de terre, représentant approximativement la pesanteur d'une couche de sol couvrant la surface d'un âcre et épaisse de six pouces et deux tiers.

Depuis le début des opérations, approximativement, 7,000 échantillons furent prélevés et classifiés; de ce nombre 4,600 furent analysés. Les auteurs ajoutent qu'au train où marchent actuellement les opérations d'échantillonnage et d'analyse, il faudra encore treize ans environ, avant de terminer le travail sur toute l'étendue de l'Etat de l'Illinois.

Dans le bulletin sommaire sur les études du sol, nous trouvons un tableau indiquant la composition chimique moyenne, de la manière décrite plus haut, de 27 types principaux des sols cultivables de l'Illinois. Un coup d'oeil permet donc de juger déjà immédiatement quels sont les éléments de fertilité dont les réserves sont généralement abondantes dans les espèces de terrains le plus souvent rencontrés; quels autres sont au minimum et menacés d'épuisement par tel ou tel genre de culture.

Conclusion sommaire de l'analyse chimique des sols

Nous les trouvons formulées comme suit parmi quelques points résumant en une seule page le contenu du bulletin 193. "Les chiffres indiquant la teneur en éléments nutritifs de différents types de sols montrent de grandes variations dans les réserves en principes alimentaires essentiels. Les sols de l'Illinois peuvent accuser le manque d'un ou de plusieurs des cinq éléments essentiels: **azote, phosphore, potassimu, calcium, magnésium.** Il en résulte que le problème de la fertilisation des terres peut être compliqué; cependant, le plus souvent, il se borne surtout à deux points qui sont: l'application d'amendements calcaires et d'engrais phosphatés conjointement avec l'enrichissement en matière organique, surtout par l'enfouissement des légumineuses.

Parcelles d'expérience

Les limites de cet article ne nous permettent pas d'exposer les traits principaux du plan suivi dans l'établissement des parcelles expérimentales. Bornons-nous à dire qu'il y a actuellement 39 champs d'expérience en opération dans autant de sections différentes de l'Etat de l'Illinois et sur des types de sols bien représentatifs et de réelle importance. Les séries de parcelles sont cultivées suivant une rotation définie et bien adaptée à la région.

Dans les rendements obtenus, au cours de la rotation, par l'emploi de combinaisons variées, d'amendements et d'engrais de formes diverses, il est tenu un compte rigoureux du résultat économique qu'eut produit l'application sur une grande échelle des divers essais.

Conclusions générales des résultats fournis par les parcelles d'expérience

Elles se trouvent inscrites en résumé dans quelques lignes figurant en tête du bulletin que nous avons sous les yeux. En règle générale, les résultats des expériences de culture concordent avec les renseignements fournis par la composition chimique des sols. Elles ont démontré:

(1) Que l'approvisionnement en matière organique et en azote constitue le principal problème à résoudre pour le cultivateur de l'Illinois.

(2) Que le phosphore est l'élément minéral qui fait le plus universellement défaut.

(3) Que la pierre à chaux moulue doit être appliquée en abondance à beaucoup de sols avant qu'ils ne puissent être améliorés d'une façon permanente.

Pour terminer, mentionnons quelques titres des nombreux bulletins, publiés par le service des études agrologiques de l'Illinois, lesquels démontrent l'activité déployée dans cette branche importante des études agricoles. A part quatorze rapports couvrant l'étude des sols (Soil Survey d'autant de comtés de l'Etat de l'Illinois, citons au hasard les titres suivants de bulletins et circulaires, que nous avons sous les yeux: "**Comment traiter les sols de l'Illinois.**" "**Un système de fertilité permanente dans l'Illinois**" **(1913)**. "**Pratique européenne et théorie américaine concernant la fertilité du sol (....).** "**Le calcaire moulu pour les terres acides**" 1912)." "**Le potassium du sol**" (1915). "**Terrains tourbeux**" (1912). "**Le prélèvement des échantillons des sols**" (1916). "**Pourquoi l'Illinois ne produit qu'une demi-récolte**" (1917.

Le Programme de nos Ecoles d'Agriculture

Par le Dr F.-C. HARRISON, du Collège Macdonald

Le programme d'étude doit répondre au but que l'on se propose.

Le collège a-t-il l'intention de former des cultivateurs, des agronomes régionaux, des spécialistes en industrie animale, en horticulture, ou en toute autre branche de l'agriculture, que son programme doit être dressé en conséquence.

Dr. F.-C. HARRISON.

Il faut, avant de jeter les bases d'un programme d'études appropriées aux besoins des cultivateurs, savoir de combien de temps ils peuvent disposer et à quelle époque ils sont libres.

Quant au cours scientifique de quatre ans, il faudra déterminer quelle préparation les candidats devront avoir pour y être admis. Leur faudra-t-il passer par le cours pratique de deux ans et conserver un certain minimum de points pour y arriver ou bien suffira-t-il que les candidats aient au préalable une certaine formation intellectuelle. Sans vouloir imposer mes vues, je suis convaincu qu'il faut bien déterminer la préparation que devront avoir les élèves pour être admis à ce cours.

On sait que certaines universités se montrent plus sévères pour l'admission de leurs élèves et qu'elles portent la durée de leurs cours à 5, 6 et 7 ans. C'est ce qui se passe quand il s'agit des sciences appliquées, du droit et de la médecine. Tel devrait être aussi le cas pour la science agricole, attendu qu'il est impossible de faire d'un candidat mal préparé un homme complet en quatre années. Je proposerais donc comme condition d'admission au cours qui conduit au titre de bachelier le certificat d'études particulier à chaque province: junior matriculation comme dans Ontario, ou bien le diplôme donné par les "High Schools" ou les académies. On pourra être moins exigeants envers ceux qui ne désirent aucun titre. Mais, pour les candidats au baccalauréat, il est absolument nécessaire qu'ils aient une bonne formation, qu'ils soient porteurs d'un diplôme équivalent à celui que décernent les **High Schools.**

Une autre condition d'admission devrait être une certaine connaissance des travaux de la ferme. La plupart des collèges d'agriculture n'enseignent pas à exécuter les travaux élémentaires de la ferme. Ces opérations s'apprennent mieux par la pratique. Je crois qu'aux Etats-Unis comme au Canada, on devient de plus en plus exigeant sur ce point. Un stage d'au moins une saison, des semailles aux récoltes, devrait être exigé. On pourrait faire crédit aux candidats étrangers qui retournent dans leur foyer de l'expérience acquise chez-eux. Mais si ceux-ci désirent s'établir au Canada, je crois qu'il serait à souhaiter qu'ils fassent le stage mentionné sur une ferme canadienne.

Quant au programme, il serait difficile d'en énumérer les différents sujets. Je ne peux qu'en donner les groupes. J'aimerais d'abord insister sur l'importance des sciences en agriculture. Elles ne sont pas moins nécessaires que pour la médecine. A moins d'avoir de solides notions de biologie, de chimie et de physique, il est impossible d'entreprendre avec succès aucun travail de **post-gradué.** Pour l'étude de la médecine et des sciences appliquées, les universités exigent une préparation scientifique plus soignée. Les étudiants en médecine doivent suivre un entraînement scientifique de deux ou trois ans, tandis que dans l'enseignement des sciences appliquées, les cours sont les mêmes pour les élèves durant les deux premières années quelle que soit leur spécialité. J'insiste donc pour que l'on consacre à l'étude des sciences, durant les quatre années, un temps proportionné à leur importance.

Si on divise les sujets du programme en trois groupes principaux, on a, comme premier groupe:

1.—La Biologie, qui comprend non seulement la botanique et toutes ses subdivisions, mais encore la pathologie, l'entomologie, la bactériologie et la génétique. Cette dernière partie, suivant moi, devrait occuper une place importante dans les travaux de tout spécialiste en agriculture.

2.—La Chimie: chimie inorganique, organique, physiologique, chimie des engrais, des aliments, etc.

3.—La Physique: il faut une étude approfondie des lois de la physique et de leur application.

Le deuxième groupe embrasse l'industrie animale, l'agronomie, l'horticulture, l'aviculture, le génie rural, l'apiculture et d'autres sujets.

Le troisième groupe comprend l'étude de la langue maternelle, parlée et écrite. Sans une connaissance approfondie de sa langue, l'élève ne peut profiter pleinement de l'enseignement donné.

De nos jours l'économie politique et sociale prennent beaucoup d'importance. Nos élèves doivent connaître les principes de l'économie politique. Le rôle qu'ils sont appelés à jouer dans nos parlements l'exige.

D'une façon ou d'une autre, la plupart de nos bacheliers sont appelés à faire de l'enseignement. C'est à des élèves, à des cultivateurs ou à des enfants qu'ils devront transmettre leurs connaissances. Notre programme devrait donc porter quelques notions de pédagogie. L'enseignement est un art qui a ses règles. Faisons-les connaître à ceux qui ont pour mission de vulgariser la science.

Au dernier groupe se rattache encore l'étude des langues étrangères. S'il n'est pas nécessaire de parler plusieurs langues, du moins faut-il pouvoir comprendre les travaux scientifiques des pays étrangers.

Voilà l'exposé succint des principaux sujets que doit comporter le programme d'enseignement agricole. La liste, comme on le voit, est déjà bien longue.

Quel arrangement doit-on donner, dans le cours régulier, aux sujets des trois groupes?

Il arrive que les élèves possédant le plus de connaissances pratiques éprouvent beaucoup de difficultés dans l'étude des sciences, tandis que ceux qui réussissent le mieux dans les sciences spéculatives connaissent peu de choses de la pratique agricole. Il faudra donc agencer le programme en conséquence. Par exemple, un élève spécialisé en patholigie végétale, qui n'aura pas appris les applications de ses théories, s'exposera à donner au cultivateur en quête de renseignement des conseils tout à fait dépourvus de sens commun. En consacrant les deux premières années du cours surtout à l'étude des sciences, tout en réservant à la pratique un temps convenable, on permettra à ceux qui ont peu d'expérience de mettre la théorie en pratique et à ceux qui ont la pratique agricole de connaître les raisons scientifiques de leurs opérations.

Durant la troisième année, on consacrerait plus de temps aux sujets qui concernent la spécialité que l'élève choisit. Par exemple, les sciences biologiques pour les spécialistes en horticulture et la médecine vétérinaire et l'élevage pour les spécialistes en industrie animale. En commençant le travail de spécialisation dès la troisième année, on peut l'approfondir davantage en quatrième année.

De plus, je propose que pour les études spéciales, on ne se contente pas du minimum qu'on exige dans les cours ordinaires. Les 33 ou 40 pour cent des points ne sont pas suffisants. Tout élève qui se spécialise doit faire des études solides.

Il ne faut pas s'attendre à voir sortir des collèges après quatre ans d'étude des spécialistes consommés. Aucune institution, serait-elle dotée du meilleur corps professoral possible, ne peut répondre à une telle attente. Tout ce que l'on peut faire durant ce temps, c'est de fournir à l'élève les principes fondamentaux, de le diriger vers l'étude du sujet qui lui convient le mieux. Le graduà devra, si possible, se perfectionner au collège même où il a obtenu ses titres ou dans une autre institution mieux outillée.

Systèmes Fédéral et Provincial d'Education au Canada

Par L. S. KLINCK, Président de l'Université de la Colombie Anglaise.

De même que pour les autres orateurs à cette convention, le Comité d'organisation ne m'a laissé que peu de latitude dans le choix de mon sujet. Toutefois, au sujet primitif qui ne comportait que l'étude des systèmes Fédéral et Provincial d'Education agricole, on m'a permis d'ajouter les systèmes suivis dans nos collèges d'agriculture. Cette extension de mon sujet me permettra de traiter plus impartialement les trois éléments considérés comme parties essentielles de l'éducation agricole au Canada.

Etant depuis quelques années en contact personnel et officiel avec les départements fédéral et provincial d'Agriculture, je crois qu'il ne serait ni juste ni loyal de critiquer ces branches du Gouvernement sans montrer en même temps quelques défauts du Collège d'Agriculture,—défauts dont je prends ma part de responsabilité, étant membre d'un de ces Collèges.

Je l'ai déjà dit, je ne me suis pas imposé cette tâche moi-même. Pour traiter cette question d'une façon impartiale, il faudrait plus d'habileté que je n'en ai, et plus de courage que je crois en avoir. Cependant, la critique quoique défavorable, n'est pas hostile. Si les remèdes que je proposerai ne vous semblent pas convenables, vous aurez l'occasion de les discuter après cette conférence; s'ils le sont ou s'ils vous suggèrent d'autres remèdes plus convenables, à la bonne heure.

Les relations entre ces trois divisions de l'oeuvre agricole est une des questions les plus importantes que cette société aura à étudier, parce qu'elles en sont la base. En traitant ce sujet, je ne ferai qu'ébaucher les principales lignes, sans suggérer rien de défnitif; j'éviterai aussi les détails de moindre importance, parce que chacun de vous pourra appliquer à l'oeuvre spéciale qu'il aura en vue, les principes que j'énoncerai.

Nous sommes tous familiers avec les faits qui se rapportent à l'origine, à l'histoire et au développement de ces trois branches du service agricole. Au début, elles eurent leurs champs d 'action séparés et distincts. Graduellement cependant, à mesure que chacune d'elles étendait sa sphère d'activité, les lignes de démarcation devinrent de moins en moins distinctes, si bien qu'aujourd'hui, dans certaines sous-divisions, dans le champs de la propagande par exemple, les limites ont disparu. Il est à craindre que le même fait ne se présente dans d'autres champs d'activité agricole.

Les raisons de cet état de choses sont faciles à trouver. Les organisations gouvernementales ou autres, naturellement et souvent à bon droit, mirent leurs énergies à répondre aux besoins du public. Il est facile à un membre d'un Collège d'Agriculture de négliger l'enseignement et les travaux de recherches pour dévouer toutes ses énergies aux travaux de propogande,

s'ilcroit que les besoins du public le demandent. Ainsi, voyons-nous dans quelques provinces les mêmes travaux conduits par deux ou trois agents différents, alors qu'il ne devrait y en avoir qu'un à s'en occuper. Il est vrai qu'il existe de beaux exemples de coopération entre les trois départements fédéral, provincial et collégial, mais malheureusement il y a aussi des exemples frappants de manque de coopération et de coordination.

Il n'y a pas d'industrie au Canada que le Gouvernement puisse protéger et encourager avec plus de convenance que celle de l'Agriculture. A part quelques exceptions, les Gouvernements ont reconnu ce fait et ont voté de larges subsides, sans se soucier assez cependant si ceux à qui ils les donnaient les emplaieraient efficacement. Plusieurs trouvent que les organisations agricoles sont trop multipliées, et le peuple demande des explications.

Il est facile de trouver les défauts d'un système, mais très difficile d'y apporter remède. Cela demande beaucoup d'adresse, d'habileté et de dévouement à la cause publique. La principale raison pour laquelle on n'a pas essayé sérieusement de réorganiser l'agriculture au Canada, c'est qu'on y rencontre trop de difficultés.

Il est évident que le mécanisme nécessaire pour diriger efficacement et économiquement les affaires agricoles de ce pays n'a pas encore atteint le degré de perfection possible. Pour vous donner un exemple, je vous rappellerai les conditions qui existaient en Colombie Anglaise au printemps de 1914. Heureusement qu'aujourd'hui ces conditions n'existent plus, et il n'y a peut-être pas une autre province où il y a tant d'entente et de coopération entre les départements. En résumé, la situation par rapport aux organisations agricoles en Colombie Anglaise en 1914, était celle-ci: La "Ferme Colonie" établie par le Gouvernement Provincial, et qui s'est acquis une réputation internationale bien méritée pour ses animaux pur sang, était sous le contrôle du Secrétaire Provincial. Le Ministre des Terres avait le contrôle des Fermes choisies pour démontrer les façons culturales à donner aux terres qu'on ne peut pas irriguer. Les démonstrations et expériences faites sur les Fermes Expérimentales sous irrigation étaient et exécutées par les représentants du département de l'Agriculture; et quand le Collège fut en voie d'organisation, on crut tout naturel de le placer sous l'égide du Ministre de l'Education qui était aussi Secrétaire Provincial. Est-il étonnant que le peuple, voyant trois services agricoles sous le contrôle d'autant de ministres, et un quatrième en voie d'organisation, commença à poser des questions assez rationnelles? Dans l'agitation qui s'en suivit, il s'est tenu une série de conférences qui ont eu pour résultat une entente parfaite sur la base qui servirait d'appui à l'union des différents services; on ne fit pas disparaître toutes les anomalies, il est vrai, mais on élimina les plus évidentes.

Cette entente a été si parfaite que le Professeur Boving a conçu un plan d'une plus grande étendue, embrassant tous ceux qui s'occupent d'agronomie dans la province; je suis tenté de m'étendre encore sur ce projet, mais me rappelant que c'est le professeur Boving qui l'a mis au jour, je lui demanderai quand l'occasion s'en présentera au cours de la discussion, de nous l'expliquer.

Ces quelques exemples que je vous ai donnés pour montrer le manque de coopération et de coordination qui existait en Colombie Anglaise, sont peut-être les plus frappants que je connaisse, mais je ne doute pas que plusieurs d'entre vous pourraient en citer d'autres que l'union et la bonne entente feraient disparaître.

Malheureusement, la coopération manque encore entre (1) les Départements Fédéral et Provincial d'Agriculture, (2) les départements provinciaux ont les mêmes problèmes ou des problèmes semblables à résoudre; (3) entre les Départements Fédéral et Provincial et les Collèges d'Agriculture, et, ce qui est encore plus regrettable, (4) entre les professeurs et les investigateurs des différents Collèges.

Si aux trois divisions principales du Service de l'Agriculture nous ajoutons: (1) la Commisson de la Conservation; (2) l'Association Canadienne des Producteurs de Graines de Semences; (3) les Conseillers Honoraires pour les Recherches scientifiques et industrielles, et d'autres que je pourrais nommer, il n'est pas surprenant que le peuple demande ce que cela signifie, et que plusieurs qui veulent le bien public se demandent s'il est bien sage d'étendre un service qui a si peu d'ordre?

Et ce n'est pas tout. Le manque de coopération et d'ordre existe souvent même entre les départements et les branches d'une même division d'un service, et entre les départements d'un même Collège. C'est très regrettable, cependant, c'est un fait, qui dépend peut-être de notre nature humaine.

L.-S. KLINCK.

Il n'y a pas à chercher loin pour trouver les raisons qui sont à la base de cet état de choses. Une éducation collégiale ou la possession d'une belle intelligence n'assure pas nécessairement une entente facile et harmonieuse. Les jalousies professionnelles, particulièrement entre spécialistes, ne sont pas inconnues; les rivalités entre départements ou entre diverses institutions empêchent le progrès. Mais la principale raison est que la sphère d'action des différents agents n'est pas définie assez clairement.

Ces conditions demandent une coopération prompte et effective. Ces difficultés réelles confronteront tout administrateur qui sera assez courageux pour entreprendre la réorganisation complète d'un département gouvernemental ou scolaire.

Tous admettent comme nécessaire l'existence du Département Fédéral, ainsi que des Départements Provinciaux et des Collèges d'agriculture, qui ont chacun des fonctions distinctes à remplir. Cependant, il y a certains travaux qui selon quelques-uns devraient être faits par deux ou plus des services dont je viens de parler; c'est là-dessus que doit se porter la discussion, c'est là-dessus que doit se concentrer notre attention, si nous voulons résoudre la question.

Avant de vous exposer mes vues sur les fonctions des trois grandes divisions de l'oeuvre agricole au Canada, permettez-moi de vous dire qu'à mon avis, il y a certains petits détails qui ne pourront être réglés d'une façon définitive, qu'après les avoir discutés, n'ayant toujours en vue que l'intérêt public. Et même alors il y aura encore des dédoublements inévitables qui cependant, dans certaines limites, seront justifiés au point de vue de l'investigateur et du professeur. Mais je souhaite que ces cas soient réduits au minimum, et lorsqu'ils sont inévitables, voyons à ce que nos énergies soient dirigées vers un même plan d'action, et publions nos résultats.

La classification suivante des fonctions que pourraient remplir les différents services de l'Agriculture est suggérée comme pouvant servir de base à une étude plus approfondie des moyens à employer pour répondre à ce pressant besoin.

Fonctions du Département Fédéral d'Agriculture

1.—Problèmes nationaux d'administration.

2.—Mesures pour contrôler la distribution et le marché.

3.—Toutes les recherches d'ordre national ou international, y comprises celles entreprises pour résoudre les problèmes de commerce interprovincial ou d'exportation.

4.—Régler l'assistance financière à donner aux provinces, d'après celle qu'elles donneront elles-mêmes.

Fonction des Départements Provinciaux d'Agriculture

1.—Questions provinciales d'administration et de contrôle.

2.—Tout travail d'expérience et de démonstration.

3.—Prendre la responsabilité des travaux de propagande là où on a le personnel voulu, sinon, laisser cette responsabilité au Collège d'agriculture.

4.—Excepté là où les Collèges d'agriculture sont sous la juridiction du Ministre de l'Education, le Département de l'Agriculture aidé du personnel du Collège déterminera le système d'éducation agricole de la province.

Fonctions du Collège d'Agriculture

1.—Enseignement: l'éducation des professeurs, de ceux qui veulent se livrer aux travaux de recherches, des cultivateurs, des membres du personnel administratif ou technique du Gouvernement, des journalistes agricoles, etc.

2.—Recherches: (a) En sciences agricoles. (b) En sciences appliquées, non en rapport avec les problèmes essentiellement interprovinciaux ou nationaux.

3.—Propagande: le nombre et le caractère des travaux de recherche et d'enseignement devront être approuvés par le Département Provincial d'Agriculture ou par le Département d'Education.

Quoique l'on ait, dans nos systèmes actuels d'administration et d'éducation agricoles, plusieurs exemples de coopération, il est évident néanmoins qu'il est absolument nécessaire qu'il y ait encore plus d'union et plus d'ordre. Il nous faut trouver un moyen de mettre les différents services en contact plus parfait et plus effectif. Il nous faut unité de but, de plan, d'action. Il nous faut uniformiser les méthodes de recherche agricole, de façon à ce que les résultats obtenus par un investigateur puissent être comparés avec ceux des autres. Pour cela il faut que ceux qui ont une même sphère d'action puissent se rencontrer et comparer leurs résultats. Ces rencontres stimuleront en même temps leur activité et les encourageront, tout en leur apportant des lumières.

A cette fin chaque membre devrait savoir en détail les travaux que chaque service doit rendre dans chaque province.

Le fait que ces projets de réforme sont conçus par des membres des services en question n'est pas une garantie de succès. Aussi serait-il préférable que quelques hommes ayant une connaissance personnelle des besoins de l'Agriculture au Canada, fassent une étude approfondie de toute la question de la division des services et de leur distribution; ces hommes ne devraient avoir aucune connection avec les services en question. En procédant ainsi, je crois que l'on pourrait établir la base d'un système agricole qui répondrait efficacement aux besoins du jour.

LE RAPPORT DE LA CONVENTION D'ORGANISATION

Notre secrétaire général, M. F. Grindley, a déjà adressé à chacun des membres de la Société le rapport de la convention d'organisation, tenue à Ottawa, au mois de juin dernier. Ce rapport contient d'importants travaux. Nous avons décidé de les traduire. Nous publions aujourd'hui les conférences de MM. Klinck, Harrison et Putnam. Au mois de février, nous donnerons la traduction des discours que prononcèrent à cette occasion, M. Reynolds, président du collège d'agriculture de Guelph et le Dr Robertson.

LA BONNE ENTENTE

En publiant son organe official dans les deux langues, la Société des Agronomes Canadiens prouve qu'il est possible, au Canada, avec de la bonne volonté de part et d'autre, de s'entendre et de travailler en coopération.

VOLUME I. FEBRUARY, 1921. NUMBER 2

Scientific Agriculture

HON. S. F. TOLMIE.
Minister of Agriculture for Canada.

La Revue Agronomique Canadienne

Scientific Agriculture

Official Organ of the Canadian Society of Technical Agriculturists

A Magazine devoted to the general advancement of Agriculture in Canada.

Published in the interests of Agricultural Science and Research.

Vol. I. Gardenvale, P. Q., February, 1921. No. 2.

CONTENTS

Published Monthly by the Industrial and Educational Publishing Company, Limited, Garden City Press, Ste. Anne de Bellevue, P. Q. 'Phone 165.

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Editor and General Secretary—FRED. H. GRINDLEY.

Subscription to any address in Canada, the United States, or the British Empire, $2.00 yearly; other countries, postage extra.

Changes of advertisements should be in the Publishers' hands ten days before the date of issue.

La Revue Agronomique Canadienne

PAGES 89-98

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:-: EDITORIAL :-:

THE JUNE CONVENTION.

The first annual convention of the Canadian Society of Technical Agriculturists will be held in Winnipeg in June next. The place of meeting, and the exact dates, have yet to be decided, and probably a definite announcement will be made about the middle of March.

The success which attended the Organizing Convention of this Society, held at Ottawa last June, and the progress which has since been made in provincial and local organization, are sufficient to ensure a large gathering in Winnipeg. It is hoped that every province will send delegates who are keenly interested in the Society, and who will be prepared to express their opinions upon the important matters that will have to be considered. The Convention will then be not only large, but representative and effective.

After all, the real service which this new organization is going to perform, has yet to be proven, and if the C. S. T. A. is going to retain in its membership all of those who have already joined, it must give consideration, and more, to quite a number of difficulties now facing the professional agriculturist. No mistake has been made in devoting the first year to the details of organization and to the consideration, by committees, of some important matters. But the next convention should see the beginning of some definite action. There is no need for many speeches upon set subjects; very little time need be given to routine business; there is no constitution and by-laws to be adopted, which occupied a full day at the Organizing Convention last June. If the next Convention is to extend for three days, the greater part of that time should be devoted to a consideration of matters which have a direct bearing upon professional agriculture in Canada; and upon the men engaged in that work.

There is no apparent reason why the Canadian Society of Technical Agriculturists should not be of the greatest possible usefulness, nor why its Conventions and Executive meetings should not, in the very near future, serve to replace many smaller meetings now being held, at which much thought is expended upon questions which could perhaps come nearer solution if brought within the scope of this society. For that reason it would seem as though the ultimate success of the next convention will depend greatly upon the personnel of those who attend it, and upon the extent to which these men will carry out the wishes of the meeting.

A fair representation cannot be expected, especially from distant provinces, unless the expenses of delegates are paid from some source outside of their own pockets. At the last Convention this expense was borne by the Society, and its finances were considerably embarrassed thereby. If the same expense is incurred at the next Convention, is it unreasonable to hope that the agricultural departments and colleges will help to bear a part of it? Many of the appointed delegates will be employees of these institutions, and as the policies of the Society, its aims and objects, and the subjects coming up for discussion, bear mainly upon the work of colleges and departments, the plea would not appear to be illogical nor one which might establish an awkward precedent. The funds of the Society would certainly be considerably less taxed if there could be some co-operation in the payment of delegates' expenses.

O. A. C. ALUMNI ASSOCIATION.

The meeting of O. A. C. graduates and ex-students in Toronto on March 10th will probably be well attended and should result in an organization having desirable objects. There are in Canada several alumni associations, some of them fairly active, and others more or less dormant. There is no agricultural alumni association that even approaches, in numerical strength, the proposed new body. We understand that there are sixteen hundred eligible members in Ontario.

The growth of the O. A. C. Alumni Association has been quite rapid. Branches have been in active operation in central and western Ontario somewhat over a year. Quite recently — in September last — it was decided to organize one provincial branch for the whole of Ontario, and thus provide a body which would represent all ex-students. Hence the meeting on March 10th. According to the letter of invitation sent out by the Secretary of the Organization Committee, "it is proposed to hold two meetings a year, one to be a field day at the O. A. C., and the other to be a rousing Convention during the winter."

Our purpose in referring editorially to this new society is twofold. We desire, in the first place, to give courteous recognition to the O. A. C. Alumni Association, to draw the attention of our readers to the meeting on March 10th, to help, in any way possible, to make that meeting entirely successful and to promise subsequent announcement of its deliberations, if such is desired. Our second purpose is to emphasize the

desirability of encouraging co-operation between the O. A. C. Alumni Association and the Canadian Society of Technical Agriculturists. Our first purpose is a very unselfish one — the latter not quite so much so.

We know that the C. S. T. A. has, at this moment, no branch in western Ontario, and that there are nearly one hundred C. S. T. A. members in that community who are therefore unorganized; we know that there have been meetings between representatives of the O. A. C. Alumni and of the C. S. T. A.; and we know that there is a desire, by both parties, to come to a mutual agreement, when organizing, that will benefit each.

We believe there is a place for both societies although the objects of each are, in the main, quite distinct. Apart from the wide difference there will necessarily be in the work which each organization may be expected to do, there are some distinctions in the general character of the two societies. One society is provincial, the other is national; one is an alumni association, and therefore more fraternal in its purposes than the other; the C. S. T. A. is devoting itself mainly to the improvement of agriculture as a science, the better recognition of trained men, the raising of the standard and status of the industry, and other objects somewhat remote from the purposes for which an alumni association is usually formed.

There should be, and there probably will be, an opportunity provided on March 10th for a meeting of the present C. S. T. A. members, many of whom belong to the O. A. C. Alumni. At that meeting the organization of a western Ontario branch of the C. S. T. A. can be considered, and if such a branch is formed and officers elected, there is no doubt that a co-operative agreement can subsequently be made with the O. A. C. Alumni Association.

THE REINDEER IN ALASKA.

We have read with a great deal of interest a well illustrated article in the July-August * 1920, issue of the Journal of Heredity, on "The Reindeer Industry in Alaska", by G. J. Lomer, LL.B. The article is written in a popular manner, describing the rapid growth in the number of animals, from 1,280 in 1892 to 200,000 at the present time; the history of the industry is traced, and details are furnished as to the characteristics, habits, breeding methods, etc., of the animals themselves.

The significant part of the article, from our point of view, is a short paragraph which points out that the United States Bureau of Biological Survey, has established an Experiment Station near Unalakleet, Alaska. It appears that there has been some deterioration caused by inbreeding and due to the difficulty of supplying new blood; the prevalence of animal diseases and pests, as well as of predatory animals, has also been encountered. These difficulties made the establishment of an Experiment Station advisable, and work is now being undertaken, under the direction of Dr. E. W. Nelson, Chief of the Bureau of Biological Surveys, towards the introduction of new breeding methods, and towards the eradication of the diseases and pests concerned.

Of greater significance still, is the fact that we have traced in this article, the whereabouts and the present duties of Dr. Seymour Hadwen, formerly Chief Animal Pathologist at the Central Experimental Farm, Ottawa. Dr. Hadwen resigned his position in the Department of Agriculture early last summer, and we knew that he had gone to Alaska. The reference in the Journal of Heredity to the work which Dr. Hadwen is doing, under the direction of Dr. Nelson, will be of special interest to many of his former friends and associates. Possibly mention has been made of it elsewhere, and at the time of his departure probably some publicity was given to his new duties—if so, we missed it, and we are grateful to Mr. Lomer, the author of the reindeer article, for furnishing us with the desired news in a most interesting manner.

We hope to get in direct touch with Dr. Hadwen, and to give to our readers at a later date, some details regarding his present work.

* The lateness of this magazine, appearing six months after date of issue, is due to a suspension of publication last summer. An effort is now being made to overtake the regular date of publication.

AFFILIATIONS.

The ultimate strength of the Canadian Society of Technical Agriculturists will be built up partly by affiliations with other technical societies. Such affiliations should only be formed after careful consideration by the Executive of the C. S. T. A., and should be based upon a definite agreement. The eligibility requirements and the objects of bodies seeking affiliation should be quite similar to those of the C. S. T. A., as otherwise there could be no sound object in linking up with the parent society. A definite plan of affiliation would have to be drawn up, and this could probably not be applied to all cases, but would have to be varied from time to time to meet different conditions. Affiliation should not be pre-supposed by any society; the terms upon which affiliation is desired should be submitted for the consideration of the proper committee of the C. S. T. A. and the subsequent details arranged when such consideration has been given.

It is doubtful if any affiliations will be completed until full consideration is given, at the June convention of the C. S. T. A., to the details involved, and to the general terms upon which affiliations would be arranged. The question will probably, therefore, be among the agenda of the Convention.

The Junius of Nova Scotia

By M. CUMMING.
Principal, Agricultural College, Truro, N.S.

Being an account of a series of remarkable letters written by John Young, the first Secretary for Agriculture of the Province of Nova Scotia, during the years 1818-19, which caused such a complete revolution in the agricultural affairs of the Province, that its financial condition was changed from a state of depression to one of prosperity, in the short space of three years.

In order to attain the end which Mr. Young had in view he assumed the press name of "Agricola" under which he so effectually concealed his identity that he baffled all the ingenuity of the curious to discover the authorship of the letters, until he himself made known the secret some nine months after the appearance of the first letter.

* * *

On July 15th, 1818, there appeared in the Acadian Recorder of Halifax, Nova Scotia, a newspaper still in existence, a letter signed "Agricola" in which the writer described the then lamentable state of agriculture in the Province of Nova Scotia and urged as a "first grand step towards internal improvement" the establishment of Agricultural Societies "in every County and in most of the townships" which "should hold meetings" and "dignify rural affairs", "excite a principal of emulation" and "draw attention to useful discoveries".

This was the first of a series of sixty-two letters which appeared for the most part weekly in the Recorder and which, from the vigour and scholastic character of their style as well as from the important scientific information they conveyed, at once attracted public attention and not only excited general interest but inspired enthusiasm in regard to the subject of which they treated. Each succeeding letter was awaited with interest and naturally speculation arose as to who was the author of the letters.

To thoroughly appreciate these letters and the influence they exerted, their setting must be understood. The Napoleonic wars had been concluded by the treaty of Paris in 1815. During the war period, money had flowed into Nova Scotia at a prodigious rate. Hay sold from £10 to £12 per ton and frequently £15; beef and mutton varied from 8d to 10d per lb.; potatoes, turnips and beets were oftener above than below 5s. per bushel. Moreover, large sums were realized from the sale of the rich cargoes and ships which were daily brought in by British cruisers. During this unprecedented prosperity, no exertion was needed by the farming body to earn a subsistence. But peace came and at once dried all the sources of this artificial prosperity. Real estate fell almost in an instant; trade declined; and in about two years after the Treaty of Paris an universal gloom had settled over the Province. It was just when the depression was at its lowest that these letters were published, proclaiming the fact that prosperity could only be re-established by the plow.

Of the sixty-two letters originally written, thirty-eight were gathered together by the author and published in a volume and some twenty-four others, while published in newspapers, never appeared in a collected form. Copies of this volume called Young's Letters of Agricola, which appeared in 1822, are difficult to obtain but are to be found in some of the older Libraries in the Province. However, such is the value of the letters and such is the high character of their literary style that a new volume is now being prepared in the office of the old Acadian Recorder and will be ready for distribution in a short time.

The subject matter of the letters consisted of a description of the low state of agriculture and the general commercial depression of the Province: of a recommendation to establish Agricultural Societies, with a description of the benefit which would result from these Institutions; of a description of the climate and of an attempt to show that the prevailing impression that Nova Scotia was not adapted to agriculture was not founded on fact. Then follows a series of discussions on Agricultural Chemistry, describing the character of plant growth, the formation of soils, the purposes and uses of different instruments of tillage, the nature and method of using of manures with special reference to vegetable and animal manures and lime. The letters conclude with a general discussion of methods of tillage including drainage and finally, with a most inspiring account of the possibilities of agriculture, — "the only stable and permanent employment of capital."

In addition to contributing this series of letters to the press, Agricola encouraged all classes of husbandmen to correspond with him, under the condition that their letters were to be addressed to "Agricola," Acadian Recorder office, Halifax. He was to have the right to remain concealed under the name of "Agricola" and to have the sole disposal of all communications. Some of these communications and replies to the same, appeared in the press and are included in the above mentioned volume and many were replied to privately. A certain Dr. Petrie acted as the go-between himself and the editor of the Acadian Recorder who did not know who Agricola was.

One is struck with the large amount of labor which must have been involved in writing the weekly letter for the Recorder, in answering the large mass of correspondence to be replied to, and in looking after his own private business, for he could not engage an Assistant in case his secret might be divulged.

Many attempts were made to discover the unknown "Agricola", and in more than one letter "Agricola" asked his readers to restrain their curiosity in respect to this matter. He tells of one attempt which showed the ingenuity of those who were trying to allay their curiosity. For a long time a clergyman of Halifax, whose interest in rural affairs was well known, was supposed to be the author. The Reverend gentleman

having on one occasion left the city for a few days, some curious person determined to test the matter. A letter, asking a question on Agriculture, which required an immediate answer, was sent to the office of the Acadian Recorder. An answer could not be received from the place where the reverend gentleman had gone in less than several days, but "Agricola" not knowing the strategy answered the letter the same afternoon and thus furnished infallible proof that the clergyman was not the mysterious "Agricola" and that, moreover, Agricola lived in Halifax.

Even at this time there were some of his more intimate friends who were suspicious of the real personality of "Agricola". Himself referring to the above mentioned instance says "By such means conjecture was drawn within narrower limits and at this date (8 months after the appearance of the first letter), there was a pretty general expectation that I would turn out to be the writer who had so long worked the secret springs of the agricultural movement."

Before, however, the personality of Agricola was suspected, some interesting public events occurred which showed the esteem in which the unknown writer was held. At a dinner in Halifax on the occasion of the Anniversary of St. Andrew, November 30th, 1818, His Excellency, The Right Honorable Earl of Dalhousie, (Governor of Nova Scotia and Founder of Dalhousie University) proposed " The health of 'Agricola' and success to his labors." In proposing the toast His Excellency stated that the personality of Agricola was unknown to him. None the less the newspaper account of the dinner states that the toast was received "with three times three and great applause."

By December, 1818, five months after the appearance of the first letter, some twenty-four Agricultural Societies had been organized in the Province and it was decided that a Society subsequently called "The Provincial Agricultural Society" should be organized in Halifax to centralize and foster the movement. A meeting for this purpose was called for December 15th 1818, at which His Excellency, The Earl of Dalhousie, presided. A most interesting account of this meeting appeared in the Acadian Recorder of December 19, 1818. The Earl of Dalhousie was declared permanent President during his administration. Other distinguished men were elected to prominent positions but when it came to the appointment of Secretary, His Excellency said that there was only one person capable of assuming that office, "Agricola" himself. As, however, Agricola was unknown to the meeting His Excellency requested the Honorable Judge Haliburton (better known as the author of Sam Slick) to act as temporary secretary until such time as Agricola would disclose himself. As a matter of fact Agricola was present at the meeting but did not take part in the proceedings. In a letter written at a later date he says that he heard the proceedings with calm indifference, although when the Governor nominated him for Secretary, a close observer might have detected him by the involuntary heat and flush which diffused his face for a moment. Up to this time his purpose of remaining forever concealed had been unshaken but this appointment made him reflect whether the mystery in which he had hitherto concealed himself might not be treachery to the cause. This question of revealing himself had to be decided before the next meeting of the Society to be called by the Governor. This meeting was held on April 13, 1819, and a few days before the meeting, Agricola himself says "I wrote His Lordship (The Earl of Dalhousie) and subscribed my real name. An interview immediately followed: and thus the long contested secret was finally divulged."

"Agricola" proved to be John Young, a Scotchman born at Falkirk, Sterlingshire, Scotland, on September 1st, 1773, who came to Halifax and established himself as a merchant in that city in 1814, who subsequently bought a farm at Willow Park (near the Halifax Exhibition grounds) and who died in Halifax on October 6th 1837. During the earlier years of his life he had studied medicine at Glasgow, where he acquired his knowledge of Science which is so well displayed in his letters. Subsequent to revealing his name he represented the then County of Sydney, (now Antigonish and Guysboro), in the Provincial Legislature for two terms. Although he was a graceful and prolific writer it is stated that he was not a brilliant speaker and that he excelled more in the councils than in the forum of the House. In Campbell's history of Nova Scotia a humorous instance is narrated of Agricola which is worth recording:

"In a debate in the House of Assembly on a grant of money for the importation of horses for the Province, several members expressed their opinion as to the most suitable breed. John Young was in favor of horses for farming purposes, of which he was considered a good judge. James B. Uniacke was in favor of importing horses, half blood, and in his remarks spoke sarcastically about the kind of horses kept by Mr. Young who lived at Willow Park and which were occasionally employed in driving agricultural produce to market. Mr. Uniacke was an eloquent speaker, graceful in manner and appearance, and by his ready wit and a sly allusion to Mr. Young's cabbage, turned the laugh of the House against that gentleman. Mrs. Uniacke was a lady possesed of a large fortune at the time of her marriage but happened, like many of the very best of her sex, not to be remarkable for her beauty. Mr. Young who had sat dreamily listening to Mr. Uniacke, by-and-by rose to reply, and with a complacent smile on his countenance said 'We, in Scotland, Mr. Speaker, select our horses upon the same principal as some gentlemen select their wives, not for their beauty, but for their sterling worth.' All eyes were immediately turned on Mr. Uniacke and there followed a universal burst of laughter."

Were this an historical magazine and were the readers all Nova Scotians it might be of interest to tell of the further measures that were used by Agricola, now working in his public capacity as Secretary of the Provincial Agricultural Board, to further promote agriculture in Nova Scotia. Particularly note-worthy was the continued organization of new Agricultural Societies, a system that has been continued in Nova Scotia up to the present date, there being now some 271 of these Societies. An account appears in the publication of Young's letters of prices offered by the Provincial Society for encouraging summer fallow, for the growing of the best fields of five acres or more of oats and two acres of turnips, etc., for the largest amount of

lime coming from a kiln, for felling the forest and for plowing matches. The prizes were all such agricultural implements as drill plows, harrows, etc. In view of the present interest in the application of lime it is of interest to quote from the Lime Competition the following: "It is expected that enterprising farmers will strain at burning a thousand bushels which will be barely adequate for ten acres of summer fallow." Valuable strains of seed were imported and at a later dater shipments of improved live stock were brought over from Great Britain and the United States.

These are the outstanding features of the work of this wonderful man whose influence is felt in the Province of Nova Scotia even to the present day. The general reader, however, will be more interested in the content of the letters than in the local history and so we will include in this article a brief review of Agricola's views in respect to Agricultural science and practice. It must be of interest to those whose knowledge of the chemistry of plant growth antedates the time of Bousignault, Leibig, Lawes and Gilbert and others, to read the views of this early writer whose knowledge of these principles was based upon the work of Priestley, Ingenhousz, Woodhouse, DeSaussure and Sir Humphrey Davy, particularly the latter. To be accurate in this respect we will quote from his letters.

To begin with he enumerates the elements of vegetation as follows: "The elements which constitute the greatest part of organized vegetable matter are oxygene, hydrogene and carbon, with, in some of the products, a little of azote (the then name for nitrogen). But in addition to these, chlorine, sulphur, phosphorus, calcium, magnesium, silicon, aluminum, potassium, and sodium, with small portions of iron and manganese, enter, either in their simpler or more complicated arrangements, into the fibre and texture of plants, or into the agents which operate on them." In a note on the preceding excerpt he says that Sir Humphrey Davy enumerates only twelve elements, leaving out chlorine, potassium and sodium as being essential to agriculture; and from the fact that Agricola subsequently finds difficulty in working these bases into his scheme, it is clear that his knowledge on agricultural chemistry is based largely upon the work of Sir Humphrey Davy.

In discussing the means by which plants take these elements into their system he says "The conclusion of the whole matter is that plants feed on decayed animal and vegetable remains and that, in addition, they must have, for the free exercise of their functions, a regular supply of water and air." In further elucidation of this point he adds "All the present experiments, which have been conducted with accuracy, seem to verge toward one point, that carbon, oxygene, hydrogene and azote, with their combinations, form the principal ingredients in the sustentation of plants and that these principles are introduced chiefly by the roots." Later in discussing the function of leaves in breathing carbonic acid from the air he is clearly worried in making a satisfactory explanation. I quote his conclusion: "Carbon, therefore, which is unquestionably a prime ingredient of vegetable food is supplied by the leaves from the atmosphere and by the roots from the earth. It is owing to this capacity of the plant to take in carbonaceous matter either above or below that so many species can be turned upside down: the roots growing into branches and the branches into roots." Had he written at a later date he would, of course, have understood carbon nutrition as well as adventitious roots, better.

In reading Agricola's chemistry of the soil, the modern student would be struck with the fact that he had not present day knowledge of chemical and physical principles, including them both in one category. For example, he states "that soils consist of only four simple and primitive earths, clay, sand, lime and magnesia." He describes a soil as defective in so far as it lacks one or other of the foregoing four principles. Concluding a discussion on this point he observes, "From all this reasoning it seems deductible that sand and clay in almost any proportion, with a quantity of lime laid on with judgment but not in excess, constitute the best and most fertile soil: and that the only mode of improvement is to supply whatever sort of these original and elementary ingredients is deficient in the composition. But all this will be far from bestowing lasting fertilities unless to the mass be added decayed animal and vegetable substances which unquestionably minister to plants their principal food and nourishment."

In connection with the foregoing the reader must remember that practically all that now constitutes the chemistry of agricultural fertilizers was unknown and that knowledge which today is possessed by almost every one was not then in the grasp of even the most enlightened. This point will be all the more impressed upon the reader as we present Agricola's views on manures and their uses.

He divides manures into two classes, the first comprehending all animal and vegetable decomposed matter, which is principally instrumental in feeding the plants, and second, fossil manures, in which class is included lime, marl, gypsum, sand, gravel and clay. The function of the second class he describes to be a very humble kind and mainly confined to indirect action, although he says that even in respect to the direct support of vegetable life fossil manures are not altogether useless.

That part, however, of his discussion of manures which bore the most practical fruit was that which had to do with the care of barnyard manure. He refers to "The stream of rich putrescible matter which issues from all barnyards," and also to the escape of vapours which is "the most wasteful prodigality." To control waste from the first source he strongly recommends the construction of "dungpits" and he gives detailed instruction as to how these should be made. In respect to fermentation he says "Sir H. Davy contends that the smallest degree of fermentation is accompanied with setting at liberty the elementary principles." Davy therefore holds that manure should be plowed into the ground in a fresh state so that all vapour might be absorbed by the earth and no loss occur. In opposition to this he quotes "the conductor of the Farmers' Magazine" (an English publication) that "unless a certain degree of putrefaction comes on in the barnyard no subsequent fermentation will take place in cold and clayey soils." This editor therefore recommends the thorough fermentation of manure before applying it to the land. Agricola in discussing these two extreme views says that the proper course lies between these extremes. Briefly he recommends that manure be mixed in alternating layers with loam or waste veget-

able matter or best of all dried peat from swamps which abounded all over the country and so he advises the making of composts, in respect to which he further said that the temperature should not be allowed to go above 100 degrees F. so that it was necessary to fork over these compost heaps whenever the temperature ran too high.

In reference to these two points, namely, the building of "dungpits" or as we now call them, manure cellars, and the making of composts, Agricola's advice was very widely adopted. The writer recently heard a New York Agriculturist who visited Nova Scotia nearly fifty years ago state that there were more manure cellars in Nova Scotia at that time than in any other part of America with which he was familiar, and the writer himself distinctly remembers that on nearly every farm near his old home, composting, as described in the foregoing, was the regular practice in the 80's and 90's and no doubt long before that.

In dealing with fossil manures Agricola says "They are much more lasting in their effects than the putrescent and do not stand in need of the same constant and periodical supply." He goes on to recommend the application of clay to sand and sand to clay and then deals with the application of lime, which he clearly regards to be the most important fossil manure with which to improve soil. To the writer the most interesting letter in the whole series is letter 27, in which he deals with the value of lime in a most interesting and lucid manner. While strongly recommending the application of lime he says "Lime may be applied in such excessive doses as to luxuriate on the very principles of life and create a complete blank in vegetation. The first dressing of lime, if in sufficient quantities, repays the husbandman with tenfold interest: but the second and third are more hazardous and seldom are profitable speculations." In further discussing lime he refers to lime made by burning the carbonated lime, to gypsum or sulphate of lime and to phosphate of lime. Gypsum he regards of little importance in Nova Scotia because it already exists in large quantities, but he describes its wonderful efficacy in the United States, in the cotton growing areas of which it has been used right up to the present time, being largely imported there from Nova Scotia. But one is particularly struck with his failure to appreciate the value of phosphate of lime which is now known to be by far the most important lime combination, constituting as it does a large proportion of all commercial fertilizers. He says "the phosphate of lime, which is another combination of calcareous earth with an acid, is of much less importance, regarded as a manure, than the carbonate and sulphate: but it occupies a place here which cannot with any propriety be left void." In further discussing this, he refers to the presence of phosphorous in bone of all kinds as well as in plants, but he seems to consider that, in the main, sufficient of this exists naturally in the soil. Upwards of fifty years were yet to elapse before Lawes and Gilbert taught the world how to use phosphate of lime to advantage.

Magnesia, which he describe as one of the four primary earths, is stated to be somewhat interchangeable with lime, but he adds that it must be used very sparingly.

It seems evident that he had not planned to include potash and soda in his scheme of manures. In fact, he says that Sir Humphrey Davy, his principal source of authority, had not referred to them at all. He, however, says "there can be no doubt that both of these fixed alkalies enter very largely into the vegetable organization and constitute an essential ingredient." Later he adds "the power of potash to accelerate vegetation may be inferred from its abundance in all parts of plants that grow on land." He advises the addition of potash to soils through the application of wood ashes, and of sodium through the application of common salt, but concludes this discussion with the following philosophic if not very scientific expression of his opinion: "The practical agriculturist will follow a safer course, in being satisfied with that quantity of saline matter which exists in his putrescible manures, as it is there skilfully compounded by that Divine Chemist, who adjusts all his natural operations by the nicest results of measure and weight."

Such in the main is the essence of Agricola's presentation of the chemical principles of soils, manures and plant growth, greatly elaborated of course, and delightfully adorned from a literary standpoint. In addition to the purely scientific letters, other letters contained advice in respect to the use of farm machinery, especially the plow, the harrow and the roller, rotation of crops, drainage and general cultivation, and, as stated in the opening paragraphs of this article, strong recommendations in respect to the organization of Agricultural Societies. The whole series is concluded with a magnificent worded tribute to the dignity and permanence of the pursuit of agriculture.

In comparing the publication with a modern treatise on agriculture, one is struck with three main differences. First of all, practically nothing is understood in respect to the modern practice of using commercial fertilizers and naturally the nature of the recommendations made would be somewhat modified, were Agricola writing in the twentieth instead of the early part of the nineteenth century. Second, little is said about the relation of live stock to the conservation of soil fertility, in respect to which it may be pointed out that the greater part of our modern knowledge of animal husbandry is the product of the past half century's work. And thirdly, and most striking of all, is the fact that the now well recognized value of clover is not referred to at all, for although some knowledge of the advantage of clover dates back to at least the opening of the Christian era, yet all our modern body of knowledge with its practical applications is another contribution of the last half of the nineteenth century.

Notwithstanding these omissions, the Treatise is a valuable one and will well repay any one who takes the time to read it. Moreover, in respect to the care of manure, the rotation of crops, and the cultivation of the soil, the facts presented by Agricola produced an effect on agricultural practice in Nova Scotia, particularly evident in the past century and still bearing fruit today. But greatest of all his contributions was his successful effort to establish Agricultural Societies in Nova Scotia, a feature of organized agriculture in the province in respect to which it is our opinion that Nova Scotia stands foremost in the Dominion of Canada.

Symbiotic Nitrogen-Fixation by Leguminous Plants with Special Reference to the Bacteria Concerned

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(Read before the Western Canadian Society of Agronomy and published through the courtesy of that Society.)

Historical.

The use of leguminous crops for the purpose of renewing the fertility of the soil dates back before the birth of Christ. The early Roman literature contains a number of references to the use and benefits of these crops. The following quotation from Columella, written in the first century, A. D. will serve as a good illustration: "Some of the leguminous plants manure the land, according to Saserna, and make it fruitful, whilst other crops exhaust it, and make it barren. Lupines, beans, peas, lentils and vetches are reported to manure the land. Where no kind of manure is to be had, I think the cultivation of lupines will be found the readiest and best substitute. If they are grown about the middle of September in a poor soil, and then plowed in (when well grown), they will answer as well as the best manure."

In addition to the crops mentioned by Columella, lucerne or alfalfa and fenugreek are mentioned in the early literature as having the same effect as manure.

Another bit of interesting historical information was added by Schultz-Lupitz, a German farmer with a somewhat scientific turn of mind who published an account of his experiences in 1881. He was growing cereals on poor sandy land with steadily decreasing crop yields. He then began growing legumes and continued until he had grown 15 consecutive crops on the same land. To his surprise instead of the yields growing smaller they increased steadily. Furthermore he found that when he sowed cereals on this land which had grown lupines, the yield of cereals was two or three times the yield of grain where no lupines had been grown. Further he noted that the nitrogen-content of the soil which had borne lupines was considerably greater than where they had not been grown. In other words, whereas the yields of cereals on his land steadily decreased, the yields of lupines increased; the lupines in some way benefited the cereal crop following; and they left the soil richer in nitrogen than before.

Neither the Romans nor Schultz-Lupitz nor the scientists of their times understood the reasons for this peculiar behavior of leguminous plants, and it remained for Hellriegel and Wilfarth to demonstrate in 1886 that legumes were able to utilize the free nitrogen of the air, that this power to utilize the free nitrogen of the air was associated with the presence of nodules on the roots, and that the presence of certain microorganisms was necessary to the process. Their experiments were conclusive, their results far-reaching. The work stands as a model in agricultural research.

In 1889 Beyerinck, a Dutch investigator, isolated and described the organisms which inhabited the root nodules.

The Nodule.

Perhaps a few words about the structure and functioning of the nodule might be of interest. The bacteria gain entrance to the host plant by dissolving the cell wall of a root-hair or by attacking the root epidermis. Once within the plant root, they multiply and make their way into the root cortex, just outside the central cylinder. We must bear in mind that in dichotyledenous plants the fibro-vascular system is centrally located. In the root cortex an irritation or stimulus is set up resulting in rapid cell division; a meristem is formed, and the young nodule emerges from the side of the root in much the same fashion as does a lateral root. But whereas in a normal lateral root the fibro-vascular system is centrally located, in

Plate I.—Nodules on the roots of young cowpea plants. These nodules are caused by bacteria which enable the plants to take nitrogen from the air.

the nodule the strands are separated by the parasitized parenchymal cells which occupy the central part of the nodule. The divided strands pass from the central cylinder of the root around the bacterial tissue and connect with the tip or meristem end of the nodule. All growth of course occurs in the meristem and these fibro-vascular strands allow the interchange of food-materials: thus the nodule is fed and thus a channel is provided for supplying the plant with nitrogen-compounds prepared by the bacteria. As the nodule grows in length, the meristem is further removed from its base of supplies, the bacteria appropriate completely the cell contents, the interchange through the fibro-vascular strands is interrupted and the nodule dies, decays and finally sloughs off. As disease bacteria

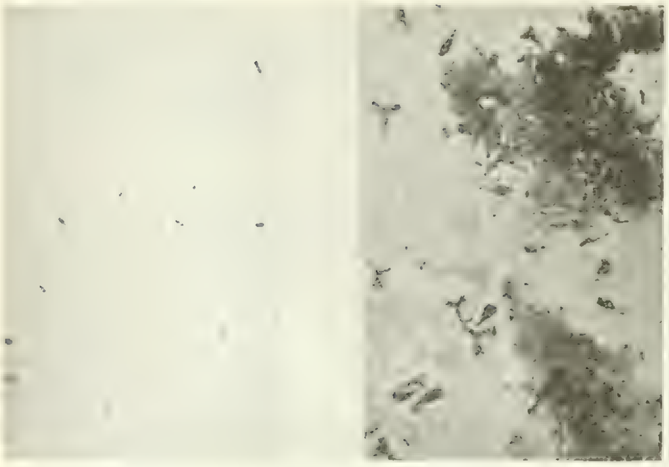

Fig. 1. Fig. 2.

Plate II.—The bacteria causing the root nodules on leguminous plants. $\times$ 1000.

Fig. 1.—The normal vegetative form showing the whip-like polar flagellum, the means of locomotion. (Cowpea bacteria.)

Fig. 2.—The so-called "bacteroids." (Red clover bacteria).

attack and destroy an animal thus defeating their own ends, so the nodule bacteria destroy their own house over their heads; they are set free in the soil and must rely upon chance providing a new opportunity.

The Bacteria.

The bacteria, for such they were found to be, are peculiar, that is if we may speak of any bacteria as being peculiar. They are able to exist in several different forms, so different that one could scarcely believe them to be the same organism. This characteristic we term polymorphism. The common vegetative form is the small rod-shaped organism. Frequently they exist as small oval bodies much smaller than the vegetative form called swarmers from the German "schwarmer" as described in the early literature. The most characteristic forms and those which identify the species are the branched X and Y forms commonly called bacteroids, a misnomer since bacteroid means something resembling bacteria, but which are not bacteria. Obviously the bacteroids are bacteria just as much as are the other forms. These peculiar forms exist frequently as huge threads with swollen end, sometimes branched to form an X or Y and sometimes variously branched with no evident scheme. In this form they are much larger than the vegetative form and more resemble fungi or actinomyces than they do bacteria.

This polymorphism led to controversies in description, in classification and in naming. No less than about twenty different names have been proposed for this helpless, unsuspecting creature, such names as *Schinzia leguminosarum*, *Bacillus radicicola*, *Cladochitrium tuberculorum*, *Rhizobium leguminosarum*, *Pseudomonas radicicola*, and so on. Some scientists believed the organism to be a fungus, some an actinomycete, and when finally agreed that it was a bacterium, they disagreed on its morphological characteristics. And so today the controversy goes merrily on; different scientists use different names. But in spite of the controversies, in spite of the weight of these numerous scientific appelations the little bug does its work uncomplaining, and we of a practical turn of mind call them nodule-bacteria and let it go at that.

Another interesting trait of the nodule-bacteria is their ability to fix nitrogen of the air without the host plant, without the nodule. This may be demonstrated by growing the bacteria in culture solutions, feeding them sugar and such mineral salts as are essential. We find, however, that the amount of carbohydrate used up as food and energy for the bacteria is very great as compared to the amount of nitrogen fixed so that if we depended upon this process under field conditions we should get very little nitrogen in return for the organic matter consumed. Furthermore the soil contains other organisms equally or more efficient in their ability to fix free nitrogen of the air, though not able to produce nodules. Among these are Azotobacter and Bacillus radiobacter. It is only when working in symbiotic relation in the root nodule that the nodule bacteria are efficient. Therefore this ability of the nodule bacteria to fix nitrogen without the host is not peculiar to the nodule bacteria alone and furthermore it does not explain the extraordinary efficiency when working symbiotically. Upon this latter point there is no explanation.

Is Symbiosis Possible Between Nodule Bacteria and Non-Leguminous Plants?

What would it mean to agriculture if we could induce the nodule bacteria to work upon the crops other

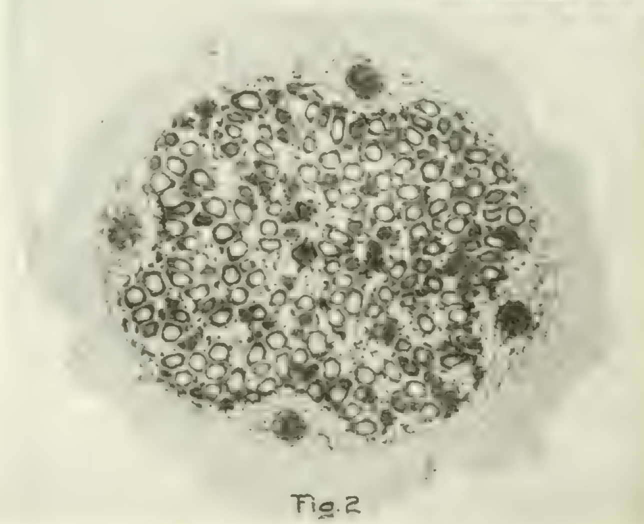

Plate III.

Fig. 1.—Longtidunal section of a nodule of red clover which was well advanced but still growing, showing vacuolated bacterized cells, vascular tissue, nodule cortex, and meristem. $\times$ 100.

Fig. 2.—Cross section of a similar nodule of red clover. Mounted in iodine solution after Flemming's triple stain to show starch. The fibro-vascular bundles are especially prominent. X 100.

Courtesy Illinois Agr. Exp. Sta.

than legumes? In the corn-belt, for example, what value would result if symbiosis were made possible with the roots of corn? Supposing in Western Canada we could produce nodules on the roots of wheat? This may seem like a rather wild proposition to tackle. As one man put it, "It is like trying to graft a horse's tail on a pig."

Upon graduating from college in 1914, the author became research assistant to Dr. T. J. Burrill, then professor emeritus in botany at the University of Illinois. Doctor Burrill will be remembered as the discoverer of pear blight, the first known bacterial plant disease, also as the first to introduce the compound microscope to students on this continent. In Bacteriology as well as in botany he was an international figure. We set out to see what could be done by way of extending the activity of the nodule bacteria to non-leguminous plants.

At the outset our scheme did not seem so wild. We knew that certain cross-inoculations existed in nature within the legume family, for example, that the bacteria infecting alfalfa and sweet clover were interchangeable. The literature contained several references where men had caused cross-inoculations to occur which did not exist in nature. For instance one man reported the inoculation of soybeans with alfalfa bacteria. The third point was that this symbiotic relation was believed to exist in certain non-legume plants. This will be treated fully later.

We set out to learn all we could about the bacteria, the root nodules, and the non-leguminous plants referred to. We secured pure cultures of nodule bacteria from all the legumes we could find, both wild and cultivated, and tried them out on all the plants for which we could obtain seeds. Thus we enlarged upon the list of known cross-inoculations that occur in nature. We tried various means of breaking the special adaptations which naturally occur. In other words we tried to bring about unnatural crosses such as had been reported, and others as well. Finally we investigated the non-legume plants which were said to function as did legumes.

Cross Inoculations.—The results of our cross inoculation studies allowed us to classify the nodule bacteria into groups, the members within each of which were interchangeable with their co-members. These groups are as follows:

Group I.

Red Clover, *Trifolium pratense.*
Alsike Clover, *Trifolium hybridum.*
Crimson Clover, *Trifolium incarnatum.*
Berseem or Egyptian Clover, *Trifolium alexandrianum.*
White Clover, *Trifolium repens.*
Zigzag, or Cow Clover, *Trifolium medium.*

Group II.

White sweet clover, *Melilotus alba.*
Yellow sweet clover, *Melilotus officinalis.*
Alfalfa, *Medicago sativa.*
Bur clover, *Medicago hispida.*
Black medick, or yellow trefoil, *Medicago lupulina.*
Fernugreek, *Trigonella foenum-graecum.*

Group III.

Cowpea, *Vigna sinensis.*
Partridge pea, *Cassia chamaecrista.*
Peanut, *Arachis hypogoea.*
Japan clover, *Lespedeza striata.*
Velvet bean, *Mucuna utilis.*
Wild indigo, *Baptisia tinctoria.*
Tick trefoil, *Desmodium canescens.*
Acacia, *Acacia armata.*
Dyer's greenwood, *Genista tinctoria.*
Lima bean, *Phaseolus lunatus.*

Group IV.

Canada field pea, *Pisum sativum arvense.*
Hairy vetch, *Vicia villosa.*
Spring vetch, *Vicia sativa.*
Broad bean, *Vicia faba.*
Lentil, *Lens esculenta.*
Sweet pea, *Lathyrus latifolius.*

Group V.

Soybean, *Glycine hispida.*

Group VI.

Garden bean, *Phaseolus vulgaris.*
Scarlet runner bean, *Phaseolus multiflorus.*

Plate IV.
Root nodules of **Ceanothus americanus.** These nodules are not produced by the bacteria infecting leguminous plants, and this plant cannot utilize nitrogen of the air.

Group VII.

Lupine, *Lupinus perennis.*
Seradella, *Ornithopus sativus.*

Group VIII.

Hog peanut, *Amphicarpa monoica.*

Group IX.

Lead plant, *Amorpha canescens.*

Group X.

Trailing wild bean, *Strophostyles helvola.*

Group XI.

Black or common locust, *Robinia pseudo-acacia.*

One of the reasons for seeking information of this kind was the desire to learn what relation existed between the bacteria and their host plants. In other words were plant relationships correlated with interchangeability of bacteria? If this were true we had in mind making a trial with nodule-bacteria on plants standing in the closest relation botanically to the legume family.

We knew in starting that alfalfa and sweet clover

were closely related botanically and when we added fenugreek this still held. Likewise vetch, peas, lentils, broad bean and sweet peas are closely related genera.

But group III proved the undoing of this theory. The family Leguminosae is divided into three subfamilies, Mimosideae, Caesalpinioideae and Papilionoideae. In our group III we have Acacia belonging to the Mimosoideae, Cassia belonging to Caesalpinioideae, and Vagna, Arachis Lespedeza, Mucuna, Baptisia, Desmodium, and Genista belonging to the Papilionoideae. Obviously the close relation of plant genera is not correlated. Of course plant classification is based on morphology and the scheme is more or less arbitrary so that we had no reason to hope for positive results.

Generally we found that species within a single genera cross-inoculated, but one exception was found to this. The lima bean. (Phaseolus lunatus) was found not to belong in group VI, among the others of the Phaseolus group, but rather in the very mixed Group III.

One of the early writers, Mazé, divided the nodule bacteria into two large groups, claiming that the special adaptations were due to the reaction of the soil. One group had become adapted to soils of an acid reaction and the other to soils of an alkaline reaction. But this theory does not explain the existence of eleven groups, and furthermore we have within these groups acid-loving and lime-loving plants, thus exploding the theory. Recently some work has been done on optimum hydrogen-ion concentration of media for the bacteria, but as yet we have no clear-cut information. The author's opinion is that we are limited to two possible theories. One is that the adaptations are explained by similarity of cell sap, the other that the bacteria contain specific enzymes which are able to dissolve the cell wall. It may be compared to having a number of Yale locks with keys.

ATTEMPTS AT BREAKING THE SPECIAL ADAPTATIONS.—As stated before several investigators reported that they had succeeded in bringing about crosses which did not occur naturally. One report stated that by growing the bacteria on nitrogen-free media for a time the bacteria became nitrogen-hungry, and when then tried on plants other than the original host the cross was successful. Without going into detail, I will say that all of our efforts in this direction and along similar lines failed absolutely.

We tried to cause the bacteria to lose their virulence on their own particular host by feeding them organic nitrogen, inorganic nitrogen (as nitrates), and all the various means of abuse we could think of. The author has grown the bacteria for two years and a half during which time they were in test-tubes containing various kinds of media, but in no case did they lose their virulence and in no case did they succeed in producing nodules on plants outside of their original group. Since this experimental work was reported, there are records of bacteria kept for six years under artificial conditions but no change resulted. Therefore it seems certain that these adaptations as they occur in nature are permanent and not subject to change; also that the earlier investigations were in error, probably through faulty technic.

NON-LEGUMES THOUGHT TO BE ABLE TO USE ATMOSPHERIC NITROGEN.—Certain plants outside of the legume family are known to have nodules on their roots. The list is as follows:

New Jersey tea (red root), *Ceanothus.*
Russian olive, *Eleagnus.*
Alder, *Alnus.*
Black pine, *Podocarpus.*
Sago palm, *Cycas.*
Sweet gale, *Myrica.*

This is not the entire list, but includes the plants with which we worked. All of these plants have nodules on the roots much resembling the nodules of leguminous plants. Certain investigators, notably Bottomly of England, claimed that these nodules contained bacteria identical with those of the nodule bacteria. In fact Bottomley claimed to have inoculated leguminous plants with bacteria isolated from the nodules of certain of those plants. He also concluded that these plants utilized atmospheric nitrogen as did leguminous plants.

Our results are as follows:

1.—The root nodules are different morphologically from the nodules of leguminous plants.

2.—The root nodules are not caused by the bacteria which cause the nodules on leguminous plants. Numerous efforts to isolate bacteria failed, and the methods used were identical with those which were successful with legume root nodules.

3.—The evidence points to a fungus as being the cause of the nodules on these non-legumes.

4.—These non-legumes are not able to utilize atmospheric nitrogen as demonstrated by trial in pots of sand, the seedlings being inoculated by applying crushed nodules, and being compelled to depend upon the air for their nitrogen supply.

Therefore we were forced to the conclusion that symbiosis is confined to the legume family, and to our knowledge does not exist outside of this family.

Our work was interrupted by the death of Doctor Burrill in 1916, but we had learned much concerning the subject. The project seemed less hopeful at the end that at the beginning. However, negative results are not without value.

In conclusion, several of the important facts regarding the nodule bacteria, may be given, as follows:

First.—Leguminous plants when inoculated by the proper bacteria, as evidenced by the presence of nodules on the roots, are able to utilize nitrogen of the air.

Second.—This symbiotic relation exists only in the legume family, and to the writer's knowledge does not occur in any non-leguminous plants, either naturally or otherwise. Within the legume family no species exists which does not possess this relation providing the proper bacteria are present.

Third.—Leguminous plants may be divided into groups according as they can be cross-inoculated by certain bacteria. These bacteria have become adapted to certain plants or groups of plants, and these adaptations which occur naturally are persistent and could not be broken down by repeated trial.

Fourth.—These special adaptations cannot be explained on the basis of close botanical relationship or soil reaction. Two theories are possible, one basing the adaptations on similarity of the root-sap of the plants, and the other presuming the existence of specific enzymes produced by the bacteria capable of dissolving the cell wall of the root hairs or root epidermis.

Fifth.—The cultivation of the bacteria in various kinds of media through long periods of time did not destroy their virulence.

The Relation of the Keel Bone to Egg Production

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(Concluded from the January Issue.)

As has been stated before, the measurement of the width of the hips was somewhat variable but consistent enough to show the value of this character for selection. There can be no doubt from the result shown in table 5 that there is a significant correlation with production. It will be noted that there is markedly less correlation to production in the first period than in the last two periods. A partial explanation of this is found in the mean widths for laying and nonlaying hens, or 7.0725 ± .0425 cm and 6.5700 ∓ .0170 cm respectively, showing that this measurement is dependent to some extent on laying condition. There is also a close relation to weight of bird as will be seen from table 7.

Patterson and Quisenberry (7) working with width of body, found that a bird showing a wide wedge was a better layer than one showing a narrow wedge, i. e., narrow at hips. The results of this experiment agree with their results in this respect.

Probably more attention has been paid to the pelvic bones than to any other structure in the fowl's body by those seeking a guide to egg production. Hogan (4) followed by Potter (8) years ago invented a "system" for telling the layer from the nonlayer based on the greater flexibility of the pelvic bones and their distance apart. Kent (5) brought out very clearly the relation between width at hips, distance between pelvic bones, size of abdomen and thickness of pelvic bones or body wall, to the laying condition of the bird. Two of these correlations have been considered in this present paper and confirm his results. He found that distance between pelvic bones and abdomen were more closely correlated with egg production than other measurements. So far as this present experiment goes, this is entirely in accord with these results, the distance between pelvic bones showing the closer relation to actual laying condition. The mean distance between pelvic bones was 3.5325±.0600 cm for the laying hens and 2.5562±.0233 cm for the 240 hens that were not laying. It is interesting to note the increase in coefficient of correlation from the first laying period to the last as shown in table 5.

Table 5.

Subject.	Relative.	Coefficient of Correlation
Width of Hips	Total Egg Production	.3560±.0352
” ”	No. of Months Laid	.2208±.0383
” ”	Highest Monthly Egg Production	.2314±.0381
” ”	Egg Production Nov. 1—Feb. 28	.1576±.0393
” ”	” ” Mar. 1—June 30	.3736±.0347
” ”	” ” July 1—Oct. 31	.3131±.0363
Distance between Pelvic Bones	Total Egg Production	.3479±.0354
” ” ” ”	No. of Months Laid	.3001±.0367
” ” ” ”	Highest Monthly Egg Production	.2946±.0368
” ” ” ”	Egg Production Nov. 1—Feb. 28	.1519±.0394
” ” ” ”	” ” Mar. 1— June 30	.2750±.0373
” ” ” ”	” ” July 1— Oct. 31	.3650±.0349
Distance between Pelvic Bones	Total Egg Production	.3026±.0366
Width at Hips		
” ”	Highest Monthly Egg Production	.2418±.0379

Table 6

	0-19	20-39	40-59	60-79	80-99	100-119	120-139	140-159	160-179	180-199	200-219	220-239	240-259	
1-16— 3-32	.	.	2	2	3	2	.	.	.	.	.	.	.	9
1-8 — 5-32	1	.	.	2	9	14	11	4	6	11	2	.	.	60
3-16— 7-32	.	.	.	7	16	13	25	25	12	12	7	8	1	126
1-4 — 9-32	.	.	1	3	4	8	7	12	5	10	3	2	1	56
5-16—11-32	.	.	1	1	.6	5	2	5	1	.	.	.	.	21
3-8 —13-32	.	.	.	2	1	1	1	1	.	.	.	.	.	6
7-16—15-32	.	.	.	.	.	2	.	.	.	.	.	.	.	2
	1	0	4	17	39	45	46	47	24	33	12	10	2	280

Thickness of Pelvic Bones, subject. Total Egg Production, relative.

Coefficient of Correl ation = .0026 .0403.

There is also a higher correlation between this character and total egg production, intensity of egg production and length of laying period than was the case with the size of abdomen.

Thickness of pelvic bones or rather of the body wall including the pelvic bones was estimated as explained before and then correlated with production. Only one correlation table is shown herewith, table 6, but the other coefficients of correlation are of the same order. It will be seen that there is no relation to egg production so far as this coefficient of correlation shows but an examination of table 6 shows that the high producers are grouped in three classes and that there is an apparent falling off in production of birds with a very thin or very thick pelvis. Graph I shows the mean production for the different classes in table 6. The classes showing the highest mean production coincide with those that include all the birds in laying condition. These results account for the low coefficient of correlation and indicate that hens with very thin or very thick pelvis are likely to be relatively poor producers. The optimum thickness is apparently approximately 1-8"—9-32, but this may be expected to vary somewhat, particularly for different breeds.

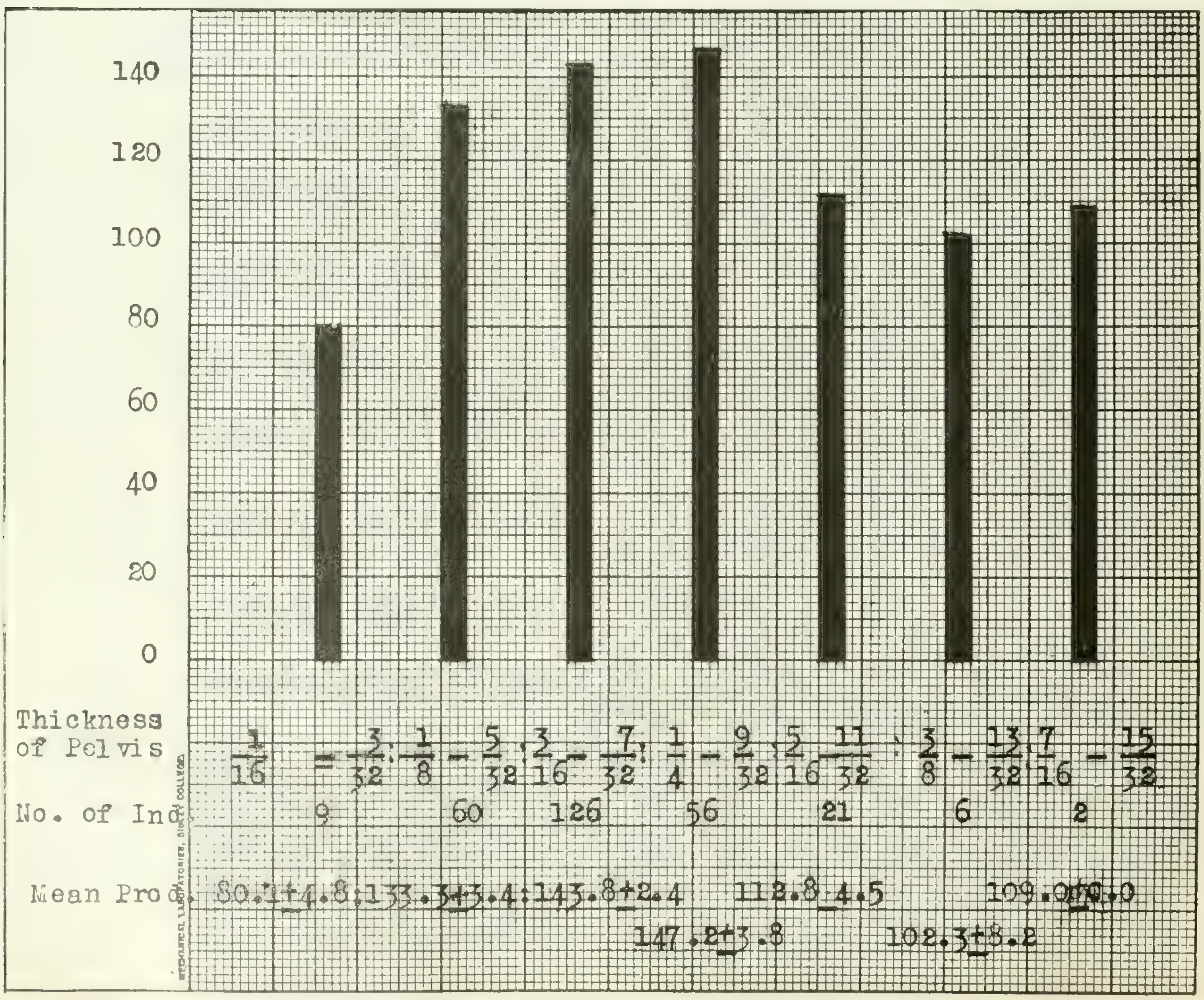
As mentioned before, Kent (5) found that thickness of pelvis or body wall showed a marked relation to laying condition. The mean thickness of pelvis for 40 laying hens was

$$\frac{6.888\pm.002z''}{32} \qquad \frac{6.8334\pm.0035''}{32}$$

for those that were not laying, showing that there was no difference in mean thickness at the time they were measured. Account must be taken, however, of the small number of birds laying and also that some of these were only in laying condition at the time of either the first or second measurement and not for both. Another is the distribution, the layers being all confined to three classes 1-8"—9-32", while there is a considerable number of birds not in laying condition that have thicker pelvic bones and some thinner. This is probably explained by the production of eggs preventing excessive deposition of fat while very thin pelvic bones would show that the bird was too thin to be in laying condition. That there is a strong correlation between thickness of pelvis and condition is shown by the coefficient of correlation, —.4644±.0316. This would therefore seem to indicate that little difference is to be expected in the mean value for layers and nonlayers although the latter are more variable.

To get an expression for the bending of the pelvic bones, the width at hips was divided into the distance

GRAPH 1



between pelvic bones. This expression correlated to egg production is shown in table 5. There is a decidedly significant correlation but when compared with the other coefficients of correlation in table 5, there is no advantage in working this out for use in selecting birds for production, as the original measurements give a higher correlation than the expression in which they are combined.

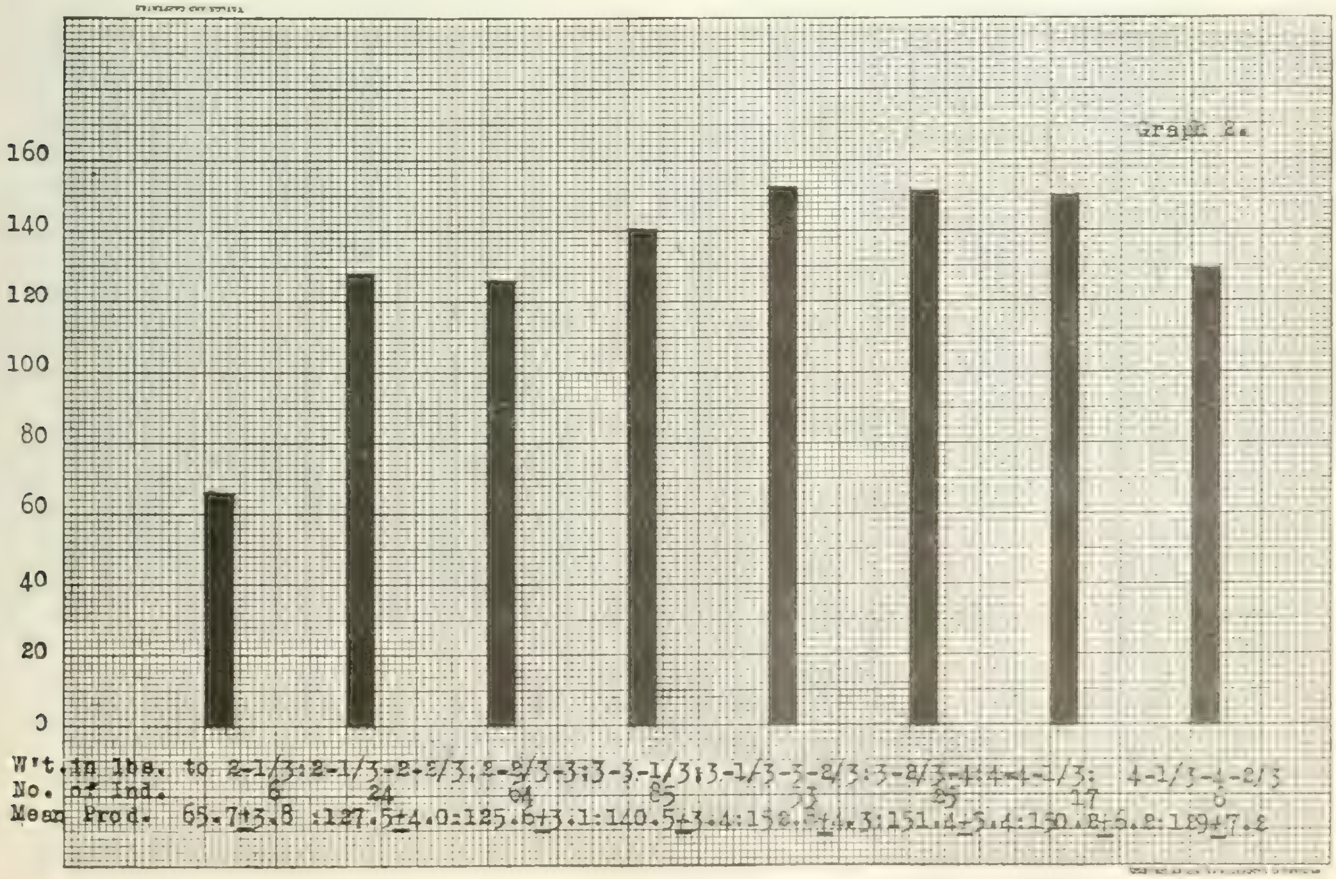
THE HOGAN "SYSTEM". — The Hogan "system" is intended primarily to serve as a means of predicting the egg production of a hen or a pullet. In the present experiment, it was, of course, impossible to use it for this purpose, but the data taken could be used to find out whether there was any relation between the expected production as based on this "system" and the actual past production of the birds.

Whitaker (9) reports a trial of this so called "system" in which Mr. Hogan predicted the number of eggs that each of about one thousand birds would lay at the First All Northwestern Laying Contest. A correlation table was made (by present writer) of the predicted and actual production of 48 birds from the report given and another for the rank of 117 birds for which the actual and predicted rank are given. The coefficients of correlation were .0641± .0970 and .0179±.0624 respectively. The deviations of predicted production from actual for 681 birds were also tabulated. These show that for 343 birds the deviation was less than 50 eggs, while 338 birds gave a deviation of over 50 eggs. For S. C. White Leghorns 161 out of a total of 335 birds showed a deviation of over 50 eggs or the average deviation would be very close to 50 eggs. While the number of birds used in the correlation tables was small, the evidence all points to the conclusion that this "system" is not a satisfactory method of predicting a bird's production.

For the present experiment, abdominal measurements were changed to a "finger" classification on the following basis: 1-2.9 cm = 1 finger; 2.9-4.5 cm = 2 finger; 4.5-6 cm = 3 finger; over 6 cm = 4 fingers. Condition of birds as heretofore considered was used for the following: Hogan classification, 2 = 1 (Hogan); 3 = 2; 4 and 5 = 3. When no allowance was made for condition, the coefficient of correlation for expected to actual production was .1481 ±.0394. There is a small correlation shown, but less than the correlation between abdomen and egg production as shown in table 3. In other words, combining thickness of pelvis with size of abdomen is a disadvantage so far as showing relationship to production goes. It is well to note in this connection that combining two measurements, even when both are related to egg production, does not seem to give an expression that is more closely related to production but rather the reverse. This was pointed out in connection with table 5 and others bear out the same point which would seem to indicate that an expression giving a closer correlation to production than the original measurements is rather hard to find.

Taking the expected egg production based strictly on the instructions given by Hogan (4) with the actual production as shown by the records gave a coefficient of correlation of .0059±.0403. It will be seen that there is apparently no relation between the two in spite of the fact that there is a correlation, though somewhat small, between past production and condition of the birds at the time that they were measured. An explanation of this result is undoubt-

GRAPH 2



edly to be found in the fact that one of the factors used (thickness of pelvis) is not related to total past production in the manner assumed in this "system", while the correlation of the other two is so small that they are of greatest value only when considered with other characters.

WEIGHT OF BIRDS. — That hens of the same breed but varying in weight are good layers without apparent relation to weight has been shown by trap-nest records. Some work has, however, been done recently by Lewis (6) and his associates at the New Jersey Experiment Station indicating that birds within certain weight limits give a higher average production than those weighing more or less. This weight is found to be approximately 3.25 to 4.75 pounds for Leghorns.

In order to get data on this point, the first three coefficients of correlation in table 7 were worked out. It will be seen from these that there is undoubtedly a significantly positive correlation between weight of birds and their production. The reason that the first coefficient of correlation is not greater is that the heaviest birds are comparatively poor producers.

In graph 2 the birds are divided into one-third pound classes. This graph shows that birds weighing from 3 1-3 to 4 1-3 pounds had a significantly higher mean production than those weighing more or less. The birds weighing from 3 to 3 1-3 pounds also show a mean production above that for the whole flock, which would seem to indicate that the best producers averaged somewhat less in this flock than birds of the same breed at the Vineland Contest. Obviously birds weighing less than 2 1-3 pounds are of little value as layers.

BROODINESS. — Broodiness is a charcteristic of fowls that varies a great deal in different varieties and in different strains. The mother instinct is more highly developed in the Asiatic class than the American, while the White Leghorn and most of the Mediterranean class are considered as practically nonsitters. That this is not always the case is shown by the fact that of the 280 birds involved in this experiment, 107 were broody from one to seven times.

In order to get an idea of what effect this had on production, the birds were divided in two classes, those that had not been broody and those that had been broody one or more times. The mean production for the broody hens was 120.7760 ± 2.6290 eggs and 146.5720 ± 2.1958 eggs for non-broody hens, a difference of over twenty eggs in favor of the latter. This result is contradictory to that of Patterson and Quisenberry (7), their figures showing a somewhat higher production for broody hens. Broodiness apparently varies with age as well as varying for different breeds and strains, so that considerable variation is to be expected with different flocks.

It would seem, from the results of this experiment, that it is decidedly worth while to find some way of distinguishing the broody from the nonbroody hens. The mean thickness of pelvis for the broody and nonbroody hens was

$$\frac{8.4661 \pm .0078''}{32} \quad \text{and} \quad \frac{6.5011 \pm .0038''}{32}$$

respectively.

The pelvis or body wall of the broody hens is therefore decidedly thicker than that of the nonbroody hens as shown by the mean. This result is explained largely by the mean egg production from July 1 to October 31. This was 28.8600 ± 1.2459 and 37.9880 ± 1.1384 eggs for the broody and nonbroody hens respectively, a difference of about nine eggs in favor of the latter.

In order to find whether any of the other characteristics studied varied with respect to previous broodiness, averages of the other measurements were made. Those are tabulated in the following table and indicate that there is practically no significant difference in any of these.

Table 8.

	Broody Average.	Non-broody Average.
1. Length of Keel	9.69 cm	9.71 cm
2. Length of Keel ÷ Weight	.00689	.00677
3. Weight	1443.8 grams	1462.3 grams
4. Width at Hips	6.60 cm	6.65 cm
5. Back — Posterior end of Keel	11.09 cm	11.25 cm

Size of Egg.

Benjamin (3) found that there was a strong correlation between size of chick and size of egg and that this relation persisted for over two years of the bird's life though gradually decreasing with age. Atwood (2) also reports similar results. Kent (5) found that there is a decided relation between weight of egg and weight of bird, thus completing the cycle. This latter result is confirmed in table 9. It will be noted that length of keel is significantly correlated with size of egg. The next coefficient of correlation in table 9 shows that there is no relation to total production. Egg weight also shows a decided correlation to the depth of the body, abdomen and other measurements that showed a relation to egg production, although there is no direct relation between the two. This same result was obtained by Kent (5) in a study of comb characters.

From these results it will be seen that where birds are selected for greater production based on anatomical characters correlated with production, they are also selected for size of egg. It should be noted that length of keel is correlated to size of egg but not to number of eggs laid, so that it would no doubt be worth while to select birds with long keels because of the relation to size of egg. It would seem that a large roomy body is indicative of a tendency to lay a large egg as well as to lay a large number. Except for weight of bird, the relation of the different char-

Table 7.

Subject.	Relative	Coefficient of Correlation.
Weight of Bird	Total Egg Production	$.2278 \pm .0382$
" "	Highest Monthly Egg Production	$.2550 \pm .0377$
" "	No. of Months Laid	$.2027 \pm .0386$
" "	Length of Keel	$.3146 \pm .0363$
" "	Width at Hips	$.6851 \pm .0214$
Length of Keel	Size of Abdomen	$-.2345 \pm .0381$

acters studied is in about the same order for both egg production and size of egg. While none shows an exceptionally high correlation to production or to weight of egg, all those showing a correlation are important and should be considered collectively rather than over-emphasising any one when selecting birds.

It will be seen by referring to table 7, that there is a marked relation shown by the characters measured to weight of birds. The same holds true for the measurements with respect to each other. This is an important point to bear in mind when selecting birds, for a hen may have depth, width at hips and other indications of being a good layer simply because of her size.

General Deductions.

1. (a) Length and curvature of keel bone show no relation to total egg production.
   (b) Straightness of keel is apparently affected by precocity.
2. Depth of body as shown by distance from back to keel is related to egg production and more particularly to intensity of production.
3. The greater the distance between the pelvic bones and the greater the width at hips, the better a hen is likely to be as a layer, provided this is not due to excessive size for the breed or strain.
4. The less bending there is of the pelvic bones the better a hen is likely to be as a layer.
5. A large abdomen, other things being equal, is indicative of laying ability.
6. (a) The optimum thickness or pelvis for the strain of Leghorns studied is approximately 1-8'' to 9-32''. In other words, a hen with a very thin or very thick pelvis (body wall) is likely to be a relatively poor producer.
   (b) A hen that has been broody during the summer will have a relatively thicker pelvis than a nonbroody hen in the fall.
7. (a) The optimum weight for the strain of Leghorns studied apparently is approximately 3 or 3 1-3 to 4 1-3 pounds.
   (b) Birds that are very large or very small for their breed or strain are likely to be relatively poor producers.
   (c) A bird that is very thin in the fall is likely to be a poor producer.
8. (a) There is no relation between size of egg and total production or intensity of production.
   (b) Length of keel is related to size of egg, i. e., a long keel is indicative of a large egg.
   (c) Anatomical characters related to egg production are also related to size of egg. That is, large birds, as indicated by weight, depth, size of abdomen, width at hips and distance between pelvic bones, are likely to lay large eggs.
9. One or two anatomical characters are not enough for selecting layers. As many as possible should be used.
10. The present experiment indicates that there is an "egg-type".

Bibliography.

1. Anon. 1917-18.
   Sixth poultry egg laying competition extending over twelve months 1917-18. E. S. R. 41, 4; 1919 digest from Utility Poultry Journal. (Harper Adams Coll) 3, No. 12, pp. 1-28.
2. Atwood, Horace. 1909.
   Some factors affecting the vigor of incubator chicks. W. Va. Agr. Expt. Sta. Bull. 124.
3. Benjamin, Earl W. 1914.
   A Study of the Variation and Inheritance of Size, Shape and Color of Eggs. Cornell University Thesis.
4. Hogan, Walter, 1914.
   The Call of the Hen (American School of Poultry Husbandry).
5. Kent, O. B. 1917.
   Constitutional Vigor in Gallus Domesticas. Cornell University Thesis.
6. Lewis H. R., Hannas, R. R., and Wene, E. H. 1919.
   The First Two Years of the Vineland Contest. New Jersey Agr. Expt. Sta. Bull. 338.
7. Patterson, C. T. and Quisenberry, T. E. 1915.
   Missouri State Poultry Expt. Sta. (Mountain Grove), Bull. No. 10, page 34.
8. Potter T. F. 1905.
   Don't Kill the Laying Hen.
9. Whitaker, Helen Dow, 1918.
   Hoganizing vs Trapnesting in Determining Egg Production. Rel. P. Journal, Vol. XXV, No. 2. April 1918.
10. Wilkins, R. H. 1915.
   A Study of the Reproductive System of the Female Domestic Fowl. Cornell University Thesis.

Acknowledgement.

I wish to thank Dr. O. B. Kent for suggesting this experiment and for much helpful advice in carrying out the experiment as well as for the use of prepared records of the birds. I also wish to thank Dr. H. H. Love for many valuable suggestions as to the biometrical interpretation of the data. Credit is also due to Mr. A. B. Holden and his assistant for their cheerful cooperation in measuring the birds.

Table 9.

Subject.	Relative.	Coefficient of Correlation.
Weight of Egg	Weight of Bird	.3838±.0344
" "	Length of Keel	.2532±.0377
" "	Total Egg Production	—.0118±.0403
" "	Dist. Back — Posterior End of Keel	.3593±.0351
" "	Distance Keel — Pelvics	.2194±.0383
" "	Width at Hips	.2779±.0372
" "	Distance between Pelvics	.2438±.0379

Mosquito Control Investigations In British Columbia

By ERIC HEARLE, Entomological Branch, Ottawa.

It is hard for those who live where mosquitoes are not abundant to realize the incomparable misery caused by the attacks of hordes of the winged plagues in less fortunate districts. In many parts of America the topography and local conditions are not suitable for the production of an abundance of mosquitoes; but in other places where low undrained areas subject to flooding by rain, tides or freshets occur, mosquitoes may be produced in such enormous numbers that they rank foremost among the enemies of man. In New Jersey, for instance, the huge salt marshes, which are flooded by the high tides, produce enormous numbers of mosquitoes, whose importance can be gauged from the following extract from the 1917 Report of the Department of Conservation and Development of New Jersey. The Board "is convinced that the salt marsh mosquitoes, more than anything or than all else, are responsible for the backwardness of the Eastern and Southern sections of the State. They have depopulated farms, prevented the growth of towns, hampered the development of shore resorts and restricted the extension of suburban communities." A very careful study of New Jersey's mosquito problem has shown that mosquito control is feasible even when very large areas are affected; and the adoption of the control measures suitable to New Jersey, indicated by the investigations of J. B. Smith and T. J. Headlee, has very greatly mitigated the pest wherever the work has been efficiently carried out.

In Canada mosquitoes are sufficiently abundant in places to be of very great importance. Investigation of some of these places is now under way and it is believed that the application of suitable control measures will result in a great reduction of the financial losses caused by mosquitoes, which losses in the aggregate amount to many thousands of dollars, to say nothing of making life infinitely more pleasant for those living in the affected areas.

The Fraser Valley, British Columbia, is one of the places periodically subjected to infestation by hordes of mosquitoes. This occurs during the period of greatest outdoor activity and absolutely takes all pleasure from life during the summer—the best season of the year.

Flooded bottom lands—The chief source of mosquitoes, Fraser Valley, B.C.

Flooded meadow—The breeding place of Aedes vexans.

The Entomological Branch of the Dominion Department of Agriculture, in response to a request from the residents of the district, has for the last two years undertaken an investigation of the problem. During the first year a faunal survey was made, and, by means of an automobile over two thousand square miles of territory were scouted for adult and larval mosquitoes. The mosquito fauna, consisting of over twenty species, was studied as to abundance, migration, virulence of poison, larval habitats, etc., and the important mosquitoes were found to be of two species which breed in the low areas bordering the Fraser river, whenever these are flooded by the spring freshets. The other species are of slight importance, either because they do not occur very abundantly, or, in some cases, because they have very poorly developed predatory instincts. During the past season a motor boat and canoe were utilized to make a careful study of the main problem and the work was largely restricted to surveys of the river-flood breeding places.

The dominant species in the district is "*Aedes aldrichi*" Dyar, a mosquito previously known only from Idaho and Montana. The larva was unknown until the writer found it last year, and as yet comparatively little is known of its life-history. The winter is passed in the egg-stage in the alder-bottom areas bordering the river. At the spring freshets extensive flood-pools are formed in these places and enormous numbers of mosquitoes are produced. The adults are capable of spreading over areas as far as fifteen miles from the breeding places. Although this species bites worst at dusk it is extremely troublesome in sheltered places all through the day and it is especially bad in berry patches. This mosquito is very small and is sage-grey in color; the legs are dark and unbanded; the abdominal segments have basal white bands; and the thorax is ornamented with a divided brown stripe.

The other important mosquito in the district is "*Aedes vexans*" Meigen, a dusty brown species with very marked constrictions in the white abdominal bands, somewhat indistinct narrow rings on the tarsal segments, and an unornamented brown thorax. The

Open Swamp Mosquitoes Resting after Emergance

Flooded Alder-bottom, Mission, B.C.

typical breeding places are open meadows and prairies bordering the river, which are flooded at high water time. The winter is passed in the egg stage and the eggs are exceedingly numerous in some places. In one meadow 642 larvae hatched from eggs which had been laid in one square foot of sod and within six minutes of the sod being submerged in warm water. The development of the immature stages varies a great deal according to climatic conditions, but the adults usually emerge within two weeks of the hatching of the eggs. They commence biting after three or four days and spread over a considerable territory in search of victims. The adult life is about six weeks.

There can be no doubt in the minds of those who have experienced a really bad mosquito season in the Lower Fraser Valley that the mosquito pest is a factor of vital economic importance in that most fertile and beautiful district. During bad seasons lumber camps are obliged to close down, road construction is hampered, and agriculture is very seriously affected. Cattle are so tormented that they are unable to feed satisfactorily and become emaciated. The drop in milk production is marked, some dairymen claiming a reduction of forty per cent. There are even a few authentic cases where cattle have actually died as a result of mosquito attacks. Even poultry have been affected during seasons of severe mosquito infestation, the hens being so pestered at night by the mosquitoes attacking their feet that they stopped laying eggs.

During years when heavy berry crops and bad mosquito infestations coincide, the picking of the berries is much hampered and a considerably wastage results. On some of the larger ranches this exceeds twenty per cent. On account of mosquitos it is almost impossible to retain farm help in some areas during the season when help is most needed. There are very few undertakings necessitating outside labor that are not affected by the pest, either directly or indirectly.

The problem is one of enormous proportions and relief can be expected only as a result of long and painstaking efforts. From our investigations we believe that it is feasible to greatly mitigate the pest, but only when a concerted and determined attempt is made by those who are mainly affected — the residents of the infested territory.

The reclamation of the larger breeding areas by dyking and pumping is the first step necessary. Much has already been done and at the present time dyking operations are being undertaken on the largest remaining area subject to flooding — Sumas Prairie — in which are 34,000 acres. Countless millions of mosquitos are produced here whenever flooding occurs. During the coming summer an aerial survey is planned to facilitate the mapping of the main breeding areas, and, with this accomplished, the investigational aspect of the work will be nearing completion. It will afterwards be possible to study other mosquito infested areas in British Columbia that are in need of investigation. In some of the richest agricultural areas in the province, the mosquito scourge is the one adverse factor that mars otherwise excellent conditions, and every effort should be made to ascertain whether mosquito control in these places is feasible or not. The problems vary with the topography and the mosquito fauna of the different districts, and special investigation is needed to ascertain the control measures best suited for each.

MARKETING.

W. A. BROWN, M.S., B.S.A., Chief, Poultry Division, Live Stock Branch, Ottawa.

Note.— In the January issue of "Scientific Agriculture", page 40, the two kinds of losses sustained by farmers through lack of business methods in marketing, were pointed out by Mr. Brown, i.e. monetary losses and loss of morale. In the following statements, attention is drawn to some business achievements in agriculture and the work of the Canadian National Poultry Association in the marketing of poultry products.—EDITOR.

Some Distinctive Business Achievements in Agriculture.

Due credit must be given to the grain growers of the west, for no one could visit the offices of "The Grain Growers' Grain Company" of Winnipeg, or the offices of the "Alberta Co-operative Elevator Company" in Calgary, or the "Saskatchewan Grain Growers" in Regina, and not be impressed with the bigness of things and the way in which the producers themselves are grappling with the marketing problem. In live stock, the activities of the producers in a marketing way in the stockyards of Toronto, Winnipeg and elsewhere are signs of the times, but there is a great gulf fixed between the sale of the animal on foot and the sale of the product to the consumer, in which, at the present time, the interests of the producer are not clearly defined or fully safeguarded. In dairy products the grading systems of the western provinces and the public auctions in Montreal stand out pre-eminently. In fruit and poultry some distinctive producers' business enterprises have been worked up, but much yet remains to be done in a co-operative way if one is to judge by the relative percentage of total volume so marketed.

Departmental Activity in Assisting Marketing.

Some difference of opinion exists between certain parts of the country as to the exact function of governments in the business of marketing. Probably as much discussion has taken place in connection with the marketing of poultry products as with any other. The National Poultry Policy adopted by the Canadian National Poultry Association is an endeavour to answer this controversy. The National Poultry Policy is as follows:

1.—Standardized Product — Government Inspected and Guaranteed.
2.—Markets Intelligence, giving an assurance of price.
3.—Co-operation in Marketing—one of the greatest assets that has come home to the rural producer.
4.—Economic Production—through stock improvement.
5.—Increased Production.
6.—Quality Payment.
7.—Service in Transportation.
8.—Perfection in Storage.
9.—Increased Consumption.
10.—Advertising and salesmanship in the disposal of the product at home and abroad.

The high, firm tone of the poultry and egg market during the past year is, in part, we believe, the answer to the question as to the effectiveness and wisdom of the policy, and emphasizes the underlying thought behind the policy; viz., to make the industry so profitable to producers that everyone will not only want to keep poultry, but more and better poultry.

The Place of Research in Agriculture

DEAN E. A. HOWES.
University of Alberta, Edmonton.

(Read before the Western Canadian Society of Agronomy and published through the courtesy of that Society.)

The application of the word research to agriculture has been subjected to considerable variation. Perhaps this is as it should be, and it has yet to be shown that a certain amount of elasticity is undesirable. It is a fact that among many the idea of research covers practically all work of an experimental nature no matter what the purpose of the experiment and notwithstanding the fact that the experiment may have been repeated hundreds of times in other times and other places. Others, no doubt of a somewhat different cast of mind, would curtail the use of the word research and apply it only to such enterprises as may be described as exploration into the realm of the entire unknown or exclusively the search for underlying principles. It has been thought well that this paper should endeavor to keep clear of either extreme, dealing with such phases of the subject as are most pertinent to our time and condition and leaving the rest to others and to other times.

It might be well at the outset to submit this idea, that possibly it would be to the advantage and in the interests of research if not only the public but also men in the so-called professional work, would establish some fairly definite line between enterprise which we may call experimental and that which may be termed demonstration. There is no intention to belittle the value of demonstration work. It has been found, particularly in new Provinces and States, that demonstration work is of prime necessity and of undoubted value. At Vermilion it was necessary for the writer to demonstrate that the growing of the sorghum of the semi-arid area of the middle West was almost out of the question in our country of cold nights. The American settlers in that locality simply had to be shown. Then again demonstration work of any kind in agriculture is always provocative of attention and interest and we must not underestimate its value in holding the interest and attention of younger people—old ones too. But when we grant all contained in the foregoing, it would seem that there is some room for protest that so much work which is purely demonstration should be termed experimental and therefore possess some claim to be classified under the heading of research. It would be well to have this work, whether in field or laboratory, properly ticketed so that all would understand the nature of the two enterprises. It is true that such definition might be objected to by some who go so far as to claim that in connection with educational institutions nothing should be attempted in the way of so-called experiment unless those in charge had a pretty fair idea of what the outcome should be. I may confess that I was taken severely to task by a prominent public man because I allowed our Professor of Animal Husbandry to undertake certain research work, the outcome of which was unknown to him, and I may admit, to a certain extent is yet unknown. Again, in visiting a good many institutions one is struck with the fact that as far as field work is concerned, they are carrying on, year after year, certain work which, because of its many repetitions in other places also, can scarcely be designated as experimental. In some places I have found that a large part of the work may be described as purely demonstration. If the men who conduct this work are content to go on with this and nothing more from year to year it is safe to suppose that they will not care to have the boundaries of research work too clearly defined. These contingencies are simply mentioned in passing to indicate that the definition of the line between research and demonstration will not be so easily accomplished as the apparent simplicity of the task would indicate.

In discussing the work of research before such a society as this, it is well to keep in mind the particular type of work pertaining to the part of our Dominion which you represent. The very fact that you have organized under the name of the Western Canadian Society of Agronomy is proof positive that you have decided that you have as a body a particular cause to serve. Having gone so far it would be well that you consider going one step farther, if you have not already done so, and organize your efforts in a way that will secure an attempt at solution of those problems most immediately pressing. One reason for this is obvious—the younger the province the less its farmers know about adaptation to its unfamiliar conditions—in other words, the greater the number of agricultural problems pressing for solution. This should be the first duty devolving upon the experimentalist. In the second place it is good policy in the interests of research. The people who ultimately pay for this service will inevitably be more sympathetic, if the results of research are closely related to the problems facing them most directly. These are two powerful reasons, simply stated, why many problems of remote application to present conditions, even though infinitely more interesting and attractive, should be left for a later date. It is not for me to dictate to you as to what these problems may be—you as a society can settle this question much better than any one individual—the important thing is that you approach the task as a body rather than as isolated individuals. Some of you may think the implied warning is partly unnecessary. This is not so; I believe we are just at the beginning of a great development in research work, and in this there are two dangers. The popularity of the work will inevitably tempt many toward what we used to call "grand stand" performances unless they are in a sense controlled by the beneficient influence of your society. In the second place we shall be exposed to the same danger experienced by our friends south of us. Government aid will increase we trust; to that financial aid will be attached certain strings, to guarantee adequate results. A man in research work will be expected to produce material for a certain amount of publication in a given time. He will produce it and some of it will not be worth much; your society should stand sponsor for the individual before that time can arrive.

Mention has been made of increased government

assistance to the work of agricultural research and the hope expressed that such recognition would not long be delayed. It is worth considering whether we would not speed the day if we could put our case more plainly before the public. It would seem to be almost axiomatic that the more concentrated the professional agriculturist is upon his work, the less business sense he may be expected to exhibit—to put it in another way, the more he values his work the less he attempts to "sell himself" to those he is earnestly trying to serve. It is the careless opportunist and dabbler in the field, that can find time to maintain an advertising department for his "short circuit" work. It is mere folly to claim that the dignity of the work does not allow such a publicity as just suggested. It is not fair to the work; leave the individual out of the question; it is only half playing the game if one achieves results, valuable at once it may be, and leave the public education factor to mere chance. Our men engaged in research work pay their way many times over and it is best that this fact be presented so that it will sink home. I need only cite the case of Marquis Wheat. Who will claim that the cost of the experiments directly and indirectly connected with the development of this wheat have not been paid off some years ago, and that our farmers have been enriched, how much it would be difficult to estimate? Another familiar case is the claim made in connection with O. A. C. No. 21 Barley:

"It is now estimated that about 96 per cent. of all the barley which is grown in Ontario belongs to the Mandscheuri or the O.A.C. No. 21 varieties. According to the report of the Bureau of Industries for Ontario the yield of barley per acre for the past sixteen years as compared with the sixteen years previous has had an increase of about 23 per cent. This increase in yield per acre throughout Ontario for the last period as compared with the first period of sixteen years would amount to about thirty-five million dollars, or sufficient to maintain the Ontario Agricultural College at its present cost of maintenance for approximately one hundred and ninety years." To come closer home and, partly for home consumption if you please, it may be noted that our Field Husbandry Department at the University has now well under way the distribution of a Red Clover which appears, after five years' trial, to be perfectly hardy for Alberta—the seed of this variety won seventh place in the open contest at Chicago. We are in receipt of many encouraging reports from those who co-operated with us in the matter of trying this out. If a satisfactory clover has been found for Alberta, this one result would justify the establishment of a Provincial Experiment Station. These are only typical instances. All our agricultural institutions are working in the same field and each year many of them are able to publish bona-fide information that more than justifies the dollars spent in their maintenance. The work of research is not being well or fairly treated if it be placed in the position of a beggar or a dependent. Before leaving this phase of the question it might not be amiss to call attention to a sinister claim that has found too much publicity during the past two years. The claim was advanced, how or when I do not know, that the discoveries of greatest value to the race were the result of chance, or of the efforts of untrained men, and therefore the money spent on research was mostly wasted. Reference was not often made to agriculture, but enough was said to make us take notice that we were being hit, even if it were over the other fellow's back. It is true that some valuable and spetacular discoveries have been the work of untrained men, at least of men not college trained. Is the inference admitted that these men would have been less efficient if they had received some college training? But we need not argue this side of the case here. The fact of the matter is that in the aggregate the great progress of the race has been due to the efforts of men who in some way or other trained themselves for this service. But they were poor advertisers and their service did not become known or at any rate well known. In the realm of mechanics important discoveries have been made by so-called uneducated men, and while we might question the matter of their lack of education, we need not trouble ourselves at this time, but content ourselves with the fact that parallel claims have no such place in agricultural science. Of course we have our lucky men, and our first-class claimers, but largely, in the realm of agricultural science, the great service to the farmer has been performed by the trained man. There need be no misgiving as to the justification for the demand for more trained men for agricultural research.

Much has been said about the scarcity of trained men for research work and coupled with this has been considerable airing of the condition of underpayment for the men engaged in this sort of work. What is the reason that the old law of supply and demand has fallen down in this instance—why has not the admitted scarcity enhanced the value of—dare I say it—the article. Well, one reason is undoubtedly the excessive modesty and lack of business sense just mentioned. Another reason advanced is that organizations such as yours have not sufficiently interested themselves in the education of the public as to the value—concrete value if you please—of the investigator to the said public. However, while we are at it we may as well clear up the whole house and admit that, in Canada at least, we have been hampered by the lack of training on the part of our investigators. Many of these men will be among the first to admit this charge. In what other field but agriculture would a man, after four years of college training be expected to get out and teach the boys of the same educational standing (perhaps higher) as he boasted four years ago? Nearly all of us are here today by the grace of pluck or luck or probably a combination of both. Similarly we have handled the question of training men for investigational work, but the time has come when we must face the condition that superior training is urgently needed, and face the other condition that our colleges and universities have barely started to meet the need.

Lest the writer be accused of dealing too much with the problem in the abstract the remainder of this paper will be devoted to outlining problems typical of what the College of Agriculture at the University of Alberta considers as most pressing for solution:

(a) In Field Husbandry the problem of frost injury with its many ramifications in crop production seems to be of paramount importance to this Province. Much has been spoken and written on this subject, but how much accurate scientific investigation has gone to back up what has been spoken or written? So important do we consider this type of problem that we are organizing our department that all such pressing issues may be investigated to their ultimate conclusion.

(b) In the Department of Soils a typical Alberta problem is the one of soil drifting. This question has been a convention topic for some time and there have

been times when we have listened to expositions on the subject which seemed more likely to aggravate the drifting conditions than to restrict them. With all due respect to what has been done in other places we feel that this very important problem should be made the subject of careful scientific investigation because of many factors apparently involved. It is fair to submit that there is a distinct possibility that some cause or causes may have been overlooked even by the most earnest investigators.

(c) In Canada until just recently Animal Husbandry was not considered as offering a field for research, and with the exception of a few very general experiments no venture was made in this important field. We have felt from the first (at this college) that we must give this department very serious consideration in our plan of experiment. We have now several pressing problems under investigation—a typical one being the feeding test of ten groups of range steers, run of the stock yards, fed upon the feeds grown in Alberta; comparatively monthly gains are recorded accurately. This is a relatively short piece of investigation, and you will get the result in the Spring, but we have many experiments running over at least three years and the results of some of these will soon be at the service of the public.

(d) Our departments of Agricultural Engineering, Dairying and Poultry have just been put in operation so it would be rather premature to submit typical experiments, but we shall try to have all the work of these departments function about the work of research.

Needless to say, no reports will be published without actual accurate experiment furnishing the material. In this connection I should like to emphasize the importance of steps being taken, by organizations of technical men, to systematically curb the tendency on the part of responsible professional men, to publish sweeping statements, backed by no scientific investigation. I refer to the Journalistic Chinooks which periodically sweep across our land, boosting some crop or variety or breed or practice, the only thing we are sure of, being that another year will see a change of subject but the same old enthusiasm. Our West is old enough to know better and it would appear that the great body of our farmers are beginning to look for something better, and it would be well that we take a lead in the matter. It is surely not too much to expect that college graduates met in serious convention, would consider taking a stand for the control of publication of scientific information. I am not finding fault with the old enthusiasm just mentioned but I am criticising adversely its misdirection. A prophet may not be without honor save in his own country but I should like to on record as prophesying that should we by some means or other be able to direct this enthusiasm toward the support of scientific research, our progress would astonish even the most optimistic among us. If we can organize the enthusiasm which has manifested itself successively in the boosting of Winter Rye, Alfalfa, Sweet Clover, Bobs Wheat, Sunflowers, Summer Fallowing, Potassium Iodide, etc., all good in themselves—perhaps—and direct this enthusiasm to the support of scientific research, we would progress by miles instead of by feet.

In conclusion the writer would sum up the subject by submitting these ideas:

(a) We are not yet in a position to accurately define boundaries for the realm of agricultural research.

(b) We must not confuse demonstration with experimentation.

(c) Present agricultural research should be governed by the more immediate needs of the state.

(d) Financially the investigator represents a profit to the state.

(e) We need more men for Agricultural Research.
We need better paid men for Agricultural Research.
We need better trained men for Agricultural Research.

(f) The problems submitted as typical of the research work under way in the University of Alberta are also typical of the problems facing all colleges and experimental stations. If a determined effort is made to hasten the better training of men for agricultural research, to secure for them better recognition for service, to organize for the best team work in problems of research, and to restrict as far as possible any tendency to short-circuit publicity, we shall go a long way to speed the dawn of that era when great advancement in agricultural service and agricultural teaching will be the record of the day.

CORRECTING ERRORS.

On page 8 of the January issue, the following should have been added to the title of Figure 4, "X=Dead tissue of old roots." Another error was made in the title of Figure 6 on page 9, where the word "Alberta" should have been "Alfalfa."

On page 20, immediately following the heading "Insects and Animal Diseases", the paragraph should read, "The relation of insects to animal diseases is now well known. The Anopheles mosquito carries the malaria organism, the Stegomyia mosquito", etc.

Readers who are retaining copies of "Scientific Agriculture" for reference purposes, should see that these corrections are made, as in each instance the addition or change has a direct bearing upon the interpretation of the text.

MEETING OF O. A. C. EX-STUDENTS.

Graduates and ex-students of the Ontario Agricultural College have been invited to attend a re-union at the Prince George Hotel, Toronto, on March 10th next, for the purpose of organizing a provincial branch of the O. A. C. Alumni. The committee which has been attending to the details of organization, is made up of C. F. Bailey, Chairman, S. E. Todd, Secretary and the following members: W. R. Reek, J. W. Widdifield, M.P.P., Col. W. J. Brown, W. J. Bell and H. S. Fry. Invitations have been sent to every ex-student whose address is known, and present indications point to a very enthusiastic convention.

BOTANICAL ABSTRACTS.

Dr. W. P. Thompson, Professor of Biology at the University of Saskatchewan, and Professor B. T. Dickson of Macdonald College, have been appointed to represent the Canadian Society of Technical Agriculturists on the Board of Control of Botanical Abstracts. The former will hold office for four years and the latter for two years.

The Effects of Premature Harvesting on the Wheat Kernel

By CHAS. E. SAUNDERS, Ph.D., Dominion Cerealist.

(Read before The Western Canadian Society of Agronomy and published through the courtesy of that Society)

It has long been know that, under ordinary conditions, grain may be cut many days, perhaps even two weeks, before it is fully mature and may still give good and fairly plump kernels when allowed to ripen in the stook. A great deal, however, has yet to be learned about the effects of premature cutting, especially such cutting as deprives the grain altogether, or to a large extent, of any food supply from the leaves or straw. It should be noted that, when grain ripens in the stook, especially under fairly cool and not too dry conditions, there is a considerable opportunity for the food supply in the plant to be transferred to the kernels, much in the same way as would have occurred had the plants been left intact. We have here two distinct problems: first, a problem which is primarily practical, namely to decide how far in advance of ripeness grain may wisely be cut when there is believed to be danger of frost, high wind, or some other destructive agency, and, second, to study the physiological processes operating towards the end of the period of development of the grain. This second problem, which appears to be rather of a purely scientific than a practical character, becomes most practical in its nature when we have to consider the effects of a rust epidemic whereby the kernel is prematurely deprived of much of the material which would have gone towards building it up. In spite of all the work which has been done, we are today unable to confidently answer the question which farmers put to us when rust appears: "Is it wise to cut grain immediately when the leaves and stems are badly attacked?"

Investigations on the effect of premature cutting have been carried on in the experimental farm system for a few years past, and the writer presents in this paper the results of one series of observations. In the summer of 1917, Mr. G. G. Moe, (then the writer's chief assistant and now assistant professor of Agronomy at the University of British Columbia) gathered a number of heads of Marquis wheat at different dates. The following was the method used. In order to make sure that we were dealing with heads of uniform degree of maturity, about 1100 heads were marked on the same day, each head showing a few anthers, but only a few. Starting on July 21st, when the wheat was still perfectly green, 100 of these marked heads were gathered every second or third day until August 15th when the wheat was considered to be ready for ordinary harvesting. These heads were gathered in four groups according to the length of straw retained. All were taken indoors and hung up in a reversed position in a warm, well-ventilated loft. In the autumn all heads were very carefully threshed out by hand, every kernel being saved. When the heads were being harvested, notes were not always made on the appearance of the plants, but the following particulars will give some idea as to the character of the kernels from some of the lots gathered. The descriptions apply to the kernels when thoroughly dry.

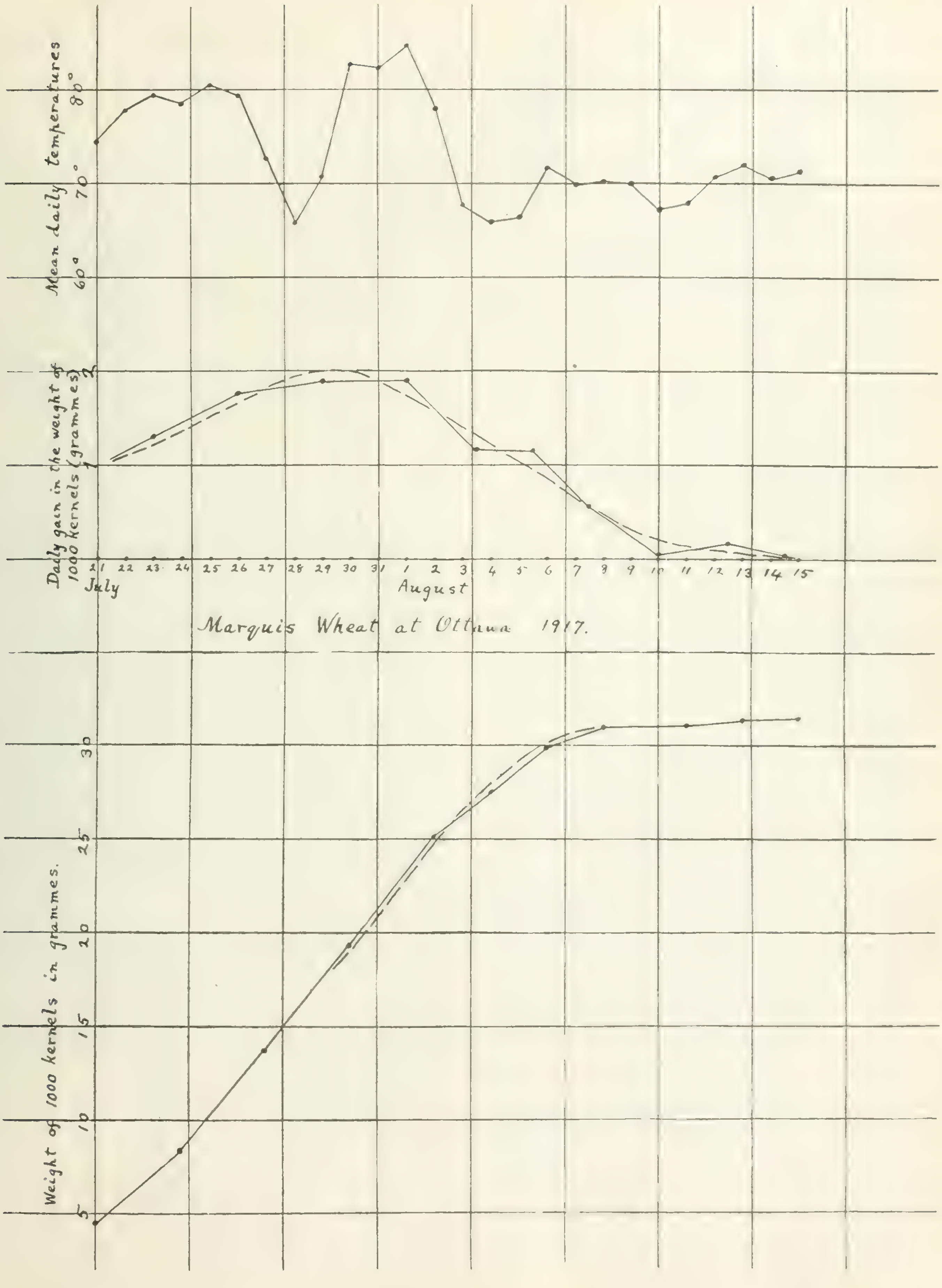
July 21st: all kernels very small and extremely shrivelled, very hard to remove from the heads;
July 24th: kernels much larger but still probably impossible to thresh with a machine;
July 27th: kernels very small but might perhaps have been threshed by a machine;
July 30th: kernels shrivelled but could be threshed out by a machine;
Aug. 4th: kernels not plump but might be accepted for milling purposes;
Aug. 8th: kernels fairly plump though not large; would be accepted for milling.

The kernels gathered on the other dates do not require special description. It should be noted, however, that the season was not favourable to the development of large kernels, so that even those harvested on the latest date (Aug. 15th) were rather small.

As a rule, the twenty-five heads in each group contained nearly 700 kernels, but the results have all been calculated on the basis of 1000 kernels. The following table gives the weight of a thousand kernels from each bunch of heads, on each date.

Marquis wheat harvested at different dates, and with different lengths of straw.

Date.	Amount of straw retained.	Weight in grammes of 1000 kernels.
July 21st	three inches	3.650
" "	half length	4.320
" "	full length	5.136
" "	fulll length with roots.	5.075
July 24th	three inches	8.176
" "	half length	8.391
" "	full length	8.114
" "	full length with roots.	9.127
July 27th	three inches	13.624
" "	half length	13.766
" "	full length.	13.688
" "	full length with roots.	13.956
July 30th	three inches	19.122
" "	half length	19.595
" "	full length	18.940
" "	full length with roots.	20.053
Aug. 2nd	three inches	25.152
" "	half length	25.042
" "	full length	23.391
" "	full length with roots.	25.152
Aug. 4th	three inches	27.546
" "	half length	27.336
" "	full length	28.082
" "	full length with roots.	27.209
Aug. 6th	three inches	29.963
" "	half length	30.564
" "	full length	29.260
" "	full length with roots.	29.598
Aug. 8th	three inches	30.770
" "	half length	30.824
" "	full length	30.859
" "	full length with roots.	31.420


Mean daily temperatures
80°
70°
60°
Daily gain in the weight of 1000 kernels (grammes)
2
1
21 22 23 24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
July
August
Marquis Wheat at Ottawa 1917.
Weight of 1000 kernels in grammes.
30
25
20
15
10
5

Aug. 11th	three inches	31.707
" "	half length	30,647
" "	full length	30.477
" "	full length with roots.	31.368
Aug. 13th	three inches	31.707
" "	half length	31,265
" "	full length	31.242
" "	full length with roots.	31.376
Aug. 15th	three inches	31.956
" "	half length	30.352
" "	full length	32.167
" "	full length with roots.	31.458

The above figures show a good deal of fluctuation which must be attributed to experimental error; yet, when the average results are taken, they are found to be fairly regular and satisfactory. The average weight of 1000 kernels for the whole period from each length of straw is as follows:

three inches	23.034	grammes
half length (about 20 inches)	22.918	"
full length	23.032	"
full length with roots	23.254	"

It is at first rather surprising to note that the heads which were gathered with only three inches of straw gave kernels fully as large as those with half length or full length of straw. They are, however, somewhat smaller than those obtained from the full length of straw with part of the roots attached. These facts can be easily explained. Under the conditions of the experiment, the drying of the straw would be very rapid and would allow scarcely any time for the transfer of material from the straw to the grain. With some of the roots attached, however, more moisture would be present and the period of activity after the harvesting would be longer. It is clear that when the drying process is very rapid, it is immaterial how much of the straw is retained.

An interesting observation on the ease with which the heads could be threshed was made during the study of this material. Quite often there was a noticeable difference in the ease of threshing between the heads with only three inches of straw and those having the full length of straw with the roots. In some cases the differences were more marked than in others. These facts can be explained in the same way as we explained the greater weight of kernel obtained from the heads with roots attached, namely, that the presence of the roots allowed a longer and therefore more thorough ripening to take place. As is well known, the riper the head, the easier it is to thresh. The heads which were gathered even as late as August 11th with only three inches of straw attached proved very hard to thresh.

In studying the irregularities of the results, one must not be too quick to suppose that they are always to be accounted for by experimental errors, because it must be remembered that the daily temperatures throughout this period fluctuated considerably. Obviously, the development of the kernel is more rapid at high temperatures, provided they be not fatally high, than under cooler conditions. During the progress of the experiment, the mean daily temperatures at Ottawa (the average between the maximum and minimum) varied from 65.9 degrees Fahrenheit on July 28th (and August 4th) to 84.8 degrees on August 1st.

The grain was cut finally on August 15th. It had then reached the proper degree of maturity for ordinary harvesting in eastern Canada, where it is often customary to allow the grain to stand in the field a good deal longer than is usually the case on the Central Plains.

Inasmuch as the differences noted between the weight of the kernels from the heads with only very short straw and those with long straw and roots were so very slight, we shall do better to consider the whole crop gathered on each date as a unit, thereby dealing with a larger number of seeds and reducing the experimental error. The average weight of 1000 kernels for each date of cutting is as follows:

July 21st.	4.545	grammes
" 24th.	8.452	"
" 27th.	13.758	"
" 30th.	19.427	"
Aug. 2nd	25.184	"
" 4th.	27.543	"
" 6th.	29.846	"
" 8th.	30.968	"
" 11th.	31.050	"
" 13th.	31.398	"
" 15th.	31.483	"

These figures form an almost perfect series which would certainly have been even more nearly perfect had there been no fluctuations in the mean daily temperatures. These results are very striking when plotted in the form of a rough curve. They show that from July 21st to about August 2nd the rate of increase in the weight of 1,000 kernels was very rapid and fairly constant, in spite of the cool weather which occurred on July 28th and 29th. The rate of increase in weight fell off after the very hot days August 1st and 2nd, and became slower and slower during the relatively cool weather which extended to the end of the experiment. There is a slight bend in the curve on the 4th of August which corresponds exactly with the low temperatures of August 3rd, 4th and 5th. When we consider the undoubted effect of temperature, we are quite justified in altering our curve slightly in accordance with the weather. Obviously a hot day will be one of abnormal activity and a cool day will show a slowing up of physiological processes. After making the slight alterations for abnormal weather the curve becomes extremely regular. (See the broken line on the chart.)

The writer also approached this matter from another point of view and has determined (as well as the available details allow) the daily gain in weight of 1000 kernels.

Gain in weight of 1000 kernels.

July 22nd, 23rd, and 24th . .	1.302	grammes per day
" 25th, 26th, and 27th . .	1.769	" " "
" 28th, 29th, and 30th . .	1.890	" " "
" 31st, Aug. 1st and 2nd.	1.919	" " "
Aug. 3rd, and 4th	1.180	" " "
" 5th, and 6th	1.152	" " "
" 7th, and 8th	.561	" " "
" 9th. 10th and 11th . .	.027	" " "
" 12th and 13th	.174	" " "
" 14th and 15th	.043	" " "

In plotting the above figures each observed point has to represent two or three days. It is therefore placed in the middle of the period. The solid line connects these determinations.

The following are the mean daily temperatures ob-

served at Ottawa during the period of this experiment.

July 21st	74.4	degrees Fahrenheit
" 22nd	77.9	" "
" 23rd	79.2	" "
" 24th	78.4	" "
" 25th	80.3	" "
" 26th	79.2	" "
" 27th	72.5	" "
" 28th	65.9	" "
" 29th	70.7	" "
" 30th	82.8	" "
" 31st	82.2	" "
Aug. 1st	84.8	" "
" 2nd	78.0	" "
" 3rd	67.7	" "
" 4th	65.9	" "
" 5th	66.5	" "
" 6th	71.5	" "
" 7th	69.9	" "
" 8th	70.6	" "
" 9th	70.0	" "
" 10th	67.3	" "
" 11th	68.0	" "
" 12th	70.8	" "
" 13th	72.0	" "
" 14th	70.7	" "
" 15th	71.3	" "

Taking into consideration these temperatures we can construct a theoretical curve (the broken line) representing what probably would have been the normal course of the development of the wheat kernel under uniform conditions of temperature. This curve shows a rapid increase in the amount of material deposited daily from July 21st up to July 28th or 29th when, had the weather been normally warm, about 2 grammes per day of solid matter would have been added to each 1000 kernels. But the weather happened to be quite cool on the 28th and 29th, so that the amount deposited was certainly less than the normal for those days. Furthermore the excessive heat on August 1st caused more than the usual activity on that day. The period of very great daily gains extends from about July 25th to August 2nd. It seems fair to conclude that July 29th would have been the date of maximum activity, under conditions of even temperature—that is to say approximately seventeen days before the date of cutting.

A deposition in the wheat of two grammes per 1000 kernels would be equal to about 1/16 of the total crop, or about 120 pounds to the acre on a fairly good field. We must remember however that not all the heads would be in exactly the same stage of development at any one time. The amount of material added per day would therefore not be quite so great as appears from the figures given here. Nevertheless, I think it safe to say that in a good field, with favourable weather conditions occurring at the time of maximum physiological activity, about 100 pounds of material per acre would be transferred daily, for a few days, to the wheat kernels.

It is evident that during the early period of the development of the wheat kernel — 20 to 25 days before cutting in this case — the materials of which the grain is composed are deposited in it at a rapid rate. This rate increases in rapidity until about 17 days before harvest. It remains stationary for a short time and then decreases quite quickly, being reduced almost to nothing several days before the ordinary time of cutting in Ontario. It would appear, therefore, that, in an ordinary Ontario summer, there would be very little loss of crop in cutting wheat about a week before the ordinary date, and allowing it to finish the ripening process under the relatively favourable conditions which obtain in an ordinary stook. In those parts of Canada where the summer weather is cooler than at Ottawa the harvesting could probably be done without appreciable loss in yield at a relatively earlier period —perhaps two weeks before the grain would have been ripe. This indeed is a common practice in nearly all those districts, east or west, where the summer season is rather short.

Through the kindness of Dr. Frank T. Shutt, Dominion Chemist, the writer is able to give the results of protein determinations made in his laboratories with the samples of wheat which we are considering. The samples from the heads gathered with three inches of straw and those from the heads gathered with full length of straw were analyzed separately. The results of the two series are similar. The average results are given in the following table. The figures have been recalculated on the basis of wheat containing ten per cent. of moisture.

Analyses of Marquis Wheat.

		Grammes of protein in 1000 kernels.
July 21st	20.02	.884
" 24th	16.42	1.337
" 27th	14.09	1.925
" 30th	14.62	2.783
Aug. 2nd	15.09	3.814
" 4th	15.41	4.287
" 6th	15.57	4.610
" 8th	15.87	4.890
" 11th	15.89	4.940
" 13th	16.03	5.045
" 15th	15.92	5.104

It is noteworthy that the percentage of protein rapidly decreased from July 21st to July 27th, then slowly increased until August 13th. The actual amount of protein present, however, increased rapidly from July 21st to August 6th and then increased more slowly until the end of the test.

Evidently, therefore, in the earliest stages of the formation of the kernel, protein is added with much greater relative speed than later on. Between the 21st and 30th of July, although the amount of protein added was very great, the addition of other constituents (chiefly carbohydrates of course) was even more rapid.

The period during which carbohydrates were deposited most rapidly is also the period during which protein was deposited most rapidly. Towards the end, both processes became much slower but the deposition of both protein and carbohydrates did not cease in this case until after August 15th, by which time the grain was fit to cut and was well advanced towards ripeness.

The process of ripening has been described as merely a drying out of the kernel. This is evidently not the case if we use the word "ripening" in the sense it usually bears in Canada. Simple drying out may be the final stage, but up to a very late date protein and other materials are being deposited in the kernel. The amount of such deposition is, however, so small that farmers are fully justified in cutting their grain quite early whenever they have good reasons for doing so.

The study of this important problem of the effects of early cutting on wheat is being continued by the writer.

Abstracts of Canadian Plant Pathological Literature

A. W. McCALLUM.
Dominion Botanical Division, Ottawa.

The abstracts and references given herewith include all the papers on plant diseases published in Canada during 1919 and 1920. For literature which appeared previous to 1919 reference must be made to the bibliography accumulated by Mr. W. A. McCubbin.

Where not otherwise stated the abstraction has been done by the writer.

Anonymous. **Black or Stem Rust of Wheat.** Dom. Exp. Farms Bull. 33: (2nd series) 5-15. 1917.—Popular account of *Puccinia graminis.*

Anonymous. **The Pathological Society.** Agric. Gaz. Canada 6 :98. 1919.—Note concerning the organization meeting of the Canadian branch of the American Phytopathological Society.

Anonymous. **Mosaic Disease in Potatoes.** Agric. Gaz. Canada 7 :557-558. 1920.

Anonymous. **"Take All." "Flag Smut" and "Ear Cockle" of Wheat.** Agric. Gaz. Canada 6: 615-619. 3 fig. 1919.—There is danger of these diseases being introduced into Canada. The first and last are well known in Europe and all three are present in Australia. "Ear Cockle" is now known to occur in Virginia while "Take All" has been found in Illinois and Indiana. "Flag Smut" also occurs in Illinois. Descriptions and control measures for each are given.

Anonymous. **A disease of pears, new to the continent of America.** Agric. Gaz. Canada 6: 951-952. 4 fig. 1919. — In September, 1919, the Division of Botany, Dominion Department of Agriculture received nearly mature pears from Kentville, N.S., which showed an unusual rot. Each pear had one or more large, circular, dark brown spots which were quite firm in texture. *Phytopaththera cactorum* was obtained in culture from these spots. This disease has been known in Europe since 1870 on various *Cacti*, maple, pine, larch and fir seedlings, apples and pears. In 1915 it was found near Itaca, N.Y.

Blair, W. Saxby. **Dusting Fruit Trees for Insects and Diseases.** Agric. Gaz. Canada 6: 16-18. 1919.

Bridge, James H. **Rusted Wheat and the Seed Situation for the year 1917.** Man. Agric. College Circ. 28: 1-12. 1916.—Seed from badly rusted plants germinates but seedlings are weak. Recommendations for use of such seed.—G. R. Bisby.

Brittain, W. H. **Spraying and dusting experiments, 1918.** Fruit Growers' Assoc. Nova Scotia Ann. Rept. 55: 102-110. 1919.

Brodrick, F. W. **A New Disease in Parsnips.** Agric. Gaz. Canada 6: 461-462. 1 fig. 1919.—A black, warty growth of unknown cause appears on parsnips soon after they have been stored. It is thought to be the same disease as that described by Cotton under the name of "canker." (See Bot. Absts. 1, Entry 1612).

Bryce, P. I. **Injurious Fungi of Ste. Anne de Bellevue, 1917.** Que. Soc. Prot. Plants Ann. Rept. 10: 49-51. 1918. Mention is made of some common fungi on fruit trees and on vegetables.

Bryce, P. I. **Can We Improve Potato Storage Metods?** Que. Soc. Prot. Plants Ann. Rept. 12: 53-59. Pl. 8. 1920.

Brief notes on the various causes of decay of potatoes in storage with suggestions on storage methods.

Cossette, J. R. **Two Years of Success with Dusting.** Agric. Gaz. Canada 6: 168-169. 1919.

Dickson, B. T. **Report of the Delegate to the Canadian Branch of the American Phytopathological Society.** Que. Soc. Prot. Plants Ann. Rept. 12: 24-27. 1920. — Abstracts of the papers presented at the 1919 meeting of this society.

Dickson, B. T. **Some Plant Diseases in the Greenhouse.** Que. Soc. Prot. Plants Ann. Rept. 12: 46-48. Pl. 3-7. 1920.

Drayton, F. L. **The Essentials of a Dominion Plant Disease Survey.** Que. Soc. Prot. Plants Ann. Rept. 12: 31-33. 1920.

Du Porte, E. M. **Insect Carriers of Plant Diseases.** Que. Soc. Prot. Plants Ann. Rept. 11: 59-65. 1919.—Suggests control of certain diseases by the use of insecticides rather than by fungicides.

Eastham, J. W. **Potato Diseases.** Agric. Gaz. Canada 6: 346-348. 1919.

Ellis, J. H. **The Stage of Maturity of Cutting Wheat when affected with Black Stem Rust.** Agric. Gaz. Canada 6: 971. 1919—An experiment conducted at the Manitoba Agricultural College indicates that when wheat is attacked by rust it should not be cut green but should be treated as if rust was absent.

Ellis, J. H. **Observations on Rust Control.** Man. Extension Bull. 41: 1-23. 1919.—Factors which hasten maturity of crop or lessen rankness of growth, lessen danger of rust. The results of experiments with different cultural methods are given.—G. R. Bisby.

Field Husbandry Staff. **Flax Growing in Manitoba.** Man. Extension Bull. 26. 1918.—Mentions wilt. G. R. Bisby.

Grisdale, J. H. **Report of the Acting Dominion Botanist.** Rept. Dom. Exp. Farms 1917-18; 38-41. 1918.

Grisdal,e J. H. **Report of the Acting Dominion Botanist.** Rept. Dom. Exp. Farms 1918-19: 57-61. 1920.

Gussow, H. T. **Club Root in Turnips.** Census and Stat. Monthly 4: 21-22. 1911.

Gussow, H. T. **The Barberry and its Relation to Black Rust of Grain.** Census and Stat. Monthly 6: 69-70. . 1913.

Gussow, H. T. **Smut Diseases and the Threshing Machine.** Census and Stat. Monthly 6: 189-190. 1913.

Gussow, H. T. **Tobacco Disease.** Census and Stat. Monthly 6: 244-245. 1913.

Gussow, H. T. **Canada's white pine possessions threatened with extermination.** Canadian For. Assoc. Spec. Bull. 1-7. 6 fig. 1914.

Gussow, H. T. **Degeneration of Potatoes.** Census and Stat. Monthly 8: 306-309. 1915.—Degeneration i.e., decline in the progeny due to pre-existent weakness in the parent should be properly used only where sexual reproduction occurs: Hence in a plant which is reproduced vegetatively true degeneration cannot occur. For the condition known as "running out" of seed the term somatic deterioration as opposed to chromosomatic degeneration is proposed. The causes of this

condition are always external and are not inherent in the seed. Frequent changing of seed is the remedy.

Gussow, H. T. **The Control of Potato Diseases.** Dom. Exp. Farms Circ. 9: 1-6. 1915.

Gussow, H. T. **Disease free Potatoes.** Proc. Spec. Bull. Dom. Exp. Farms 75-93. 1915.

Gussow, H. T. **Report of the Dominion Botanist.** Rept. Dom. Exp. Farms. 1916-17: 40-41. 1918.

Howitt, J. E. **Potato Disease Investigation.** Agr. Gaz. Canada 6: 247-249. 1919. — Leaf roll and mosaic have been found to be very prevalent in Southern Ontario and comparatively uncommon in Northern Ontario. Blackleg and rhizoctonia are the two most serious diseases of potatoes in Northern Ontario. An educational campaign has been carried on to acquaint the potato growers with the disease situation in Ontario and with the desirability of obtaining seed potatoes from Northern Ontario.

Jackson, V. W. **Rusts and Smuts of Grain Crops.** Man. Extension Bull. 44: 1-35. 1919.—Popular, but including results of observations and experiments on rusts and smuts.—G. R. Bisby.

Jackson, V. W. **How to spot Potato Diseases in July.** Man. Dept. of Agric. Circ. 52: 1-6. 1919.—G. R. Bisby.

Jackson, V. W., and Bisby, G. R. **Potato Top Diseases in July and August.** Man. Dept. of Agric. Circ. 52: (3rd edition) 1-6. 1920.—G. R. Bisby.

Macoun, W. T. **Blight Resistant Potatoes.** Canadian Hort. 42: 129-156. 1919.

Macoun, W. T. **Varieties of Potatoes Resistant to Late Blight or Rot.** Agric. Gaz. Canada 6: 331-332. 1919.

Maheux, Georges. **Spraying to Increase Potato Production.** Que. Soc. Prot. Plants Ann. Rept. 12: 43-46. 1920.

McCallum, A. W. **The Nature and Aims of Forest Pathology.** Agric. Gaz. Canada 7: 737-738. 1920.

McCubbin, W. A. **The Diseases of Tomatoes.** Dominion Exp. Farms Bull. 35. (2nd series) 5-16; Fig. 1-8. 1918.

McCubbin, W. A. **Brown Rot of Stone Fruits.** Agric. Gaz. Canada 6: 429- 432. 1919. — A survey was made in 1918 in Southern Ontario to study the occurrence of *Sclerotinia cinerea*. Apothecial clusters with from 1 to 111 cups per cluster were found as follows—plum 4.1 clusters and peach 5.1 clusters per tree. These are probably minimum figures as later 26.3 clusters per tree were found. Blossom infection occurred at the rate of 10.2% in cherries, 6.4% in plums and 2.6% in peaches. The fungus was found in 76.5% of leaf curl twigs. The field loss of mature fruit was found to be 7.9% for plums and 2.9% for peaches. On the market the loss was 8% for plums and 8.5% for peaches.

McCubbin, W. A. **Notes on Diseases in 1918.** Agric. Gaz. Canada 6: 433-436. 1919.—Brief notes on the following; winter injury of fruit trees; petiole infection of *Platanus americana* by *Gnomonia veneta* causing leaf fall; tomato rot caused by *Ascochyta* sp.; *Pyropolyporus ribis* on red currants; *Palargonium* wilt probably due to *Verticillium;* rot of cucumbers by *Rhizopus nigricans;* girdling of peach trees in nursery rows thought to be due to *Sclerotinia cinerea*; plum fall possibly due to intense heat and drought conditions: lightening injury to tomatoes; leaf spot of peach caused by *Bacterium pruni*; silver leaf of plums and peaches due to a mite.

McCubbin, W. A. **Abstracts of Canadian Plant Disease Literature.** Que. Soc. Prot. Plants Ann. Rept. 11: 72-83. 1919.—Presents abstracts of all plant disease literature published in Canada up to the end of 1918.

Murphy, P. A. **Potato Inspection Service.** Agric. Gaz. Canada 6: 217-223. 9 fig. 1919.—Leaf roll and mosaic the two commonest potato diseases in Canada which cause "running out" of seed are carried and spread mainly by seed but as yet it is impossible to determine whether or not a tuber is infected. Only by field inspection of the growing plants is it possible to know whether or not the tuber will be fit for seed. In Southern Ontario and Quebec a survey of 1,336 fields made in 1918 showed leaf roll in native seed plants to the extent of 15% and mosaic of 7%. As leaf roll plants produce only 1/3 of a normal yield and mosaic plants 2/3, the "running out" of seed here must be attributed to these diseases more than to any other single factor. To overcome this trouble disease free seed must be imported and in the case of Southern Ontario this comes from Northern Ontario and the Maritime Provinces. Thus the Southern Ontario grower has to buy a commodity the most important character of which he has no means of judging. Here the potato inspection service helps both parties, its certificates adding substantially to the value of the seed for the seller and ensuring practically disease free seed to the buyer. After harvesting a second examination is made of those crops which reached the necessary standard in field inspection. Tuber rots and blemishes, freedom from mixture with other varieties and type of potato are given attention. If satisfactory, a tag for each bag or barrel is provided.

Murphy, P. A. **Potato Inspection Service in 1919,** Agric. Gaz. Canada 7: 308-310. 1920.—A summary of the work of the federal potato inspection service for 1919. 1,605 seed growers asked for and received inspection. In 1918 the fields of 3,492 growers were inspected the reduction being due to the fact that in that year inspections were made voluntarily without the request of the grower. In 1919 only those who asked for inspection received it. In Prince Edward Island the price for certified seed was 70% in excess of market price.

Nelson, J. A. **Asparagus Culture.** Man. Extension Bull. 22. 1918.—Mention made of rust.—G. R. Bisby.

Rankin, W. H. **Efficiency Factors in Potato Spraying.** Que. Soc. Prot. Plants Ann. Rept. 11: 49-55. 1919. —Discusses troubles which spraying controls and gives proper methods of making and applying Bordeaux mixture. Community spraying as practised in parts of New York State is recommended for this country.

Sanders, G. E., and A. Kelsall. **Some miscellaneous observations on the origin and present use of some insecticides and fungicides.** Proc. Ent. Soc. Nova Scotia 1918: 69-75. 1919.

Sanders, G. S., and A. Kelsall. **A copper dust.** Proc. Ent. Soc. Nova Scotia 1918: 32-37. 1919.

Sanders, G. E., and W. H. Brittain. **A modified Bordeaux mixture for use in apple spraying.** Proc. Ent. Soc. Nova Scotia 1918: 51-61. 1919.

Sanders, G. E. **Apply Spraying in 1919.** Fruit Growers' Assoc., Nova Scotia Ann. Rept. 55: 110-118. 1919.

White, J. H. **On the Biology of** ***Fomes Applanatus*** (Pers.) Wallr. Trans. Royal Canadian Inst. 12: 133-174. Text fig. 1-2. Pl. 2-7. 1919—This common, wood-des-

troying fungus is now to be added to the list of wholly culturable forms, it having been cultured through from spore to spore under artificial conditions. By the application of bacteriological principles the connection between a known type of decay and a presumed causal organism has been fully established. This fungus which has generally been regarded as a saprophyte has been shown to possess the capacity of acting as a parasite. In attempting to solve the question of its parasitism three lines of investigation were followed:— (1) accumulation of evidence of apparent parasitism in nature; (2) direct examination of invaded tissues to determine whether or not they were living; (3) inoculation of healthy trees. Abundant positive evidence was obtained in support of the first. Tyloses and wound gum were present in the cells at the advance limit of decay. This is the best criterion available at present in deciding whether or not a fungus is acting parasitically. The inoculation work was inconclusive because the controls showed results similar to those produced in the inoculated trees.

Zavitz, C. A. **Loose Smut in Oats and Stinking Smut in Wheat.** Ont. Agric. College and Exp. Farm Ann. Rept. 39: 132-135. 1913.—Reports experiments which were continued for five years testing out eight of the treatments recommended for the control of loose smut of oats and bunt. The greatest yields per acre of both oats and winter wheat were produced from grain which had been immersed for twenty minutes in a solution made by adding one-half pint of formalin to twenty-one gallons of water. Immunity tests for oats to smut carried on for twelve years show that there are great differences in susceptibility among the different varieties. The Early Ripe variety is almost immune to smut while of the varieties used Black Tartarian is most susceptible.

Progress of Fruit Breeding in Canada

Following is a summary of an address given before the members of the Eastern Ontario local branch of the C. S. T. A. on Jan. 7, 1921, by W. T. Macoun, Dominion Horticulturist.

There are eight men who might be called the pioneer fruit breeders of Canada, all of whom are now dead, namely, Wm. Saunders, London and Ottawa, Ont.; Charles Arnold, Paris, Ont.; Peter C. Dempsey, Albury, Ont.; W. H. Mills, Hamilton, Ont.; Wm. Haskins, Hamilton, Ont.; James Dougall, Windsor, Ont.; W. H. Read, Port Dalhousie, Ont.; and Francis Peabody Sharp, Woodstock, N.B.

Varieties of fruit which these men originated which are grown to any extent commercially in Canada are the Josselyn (Red Jacket) gooseberry, originated by Wm. Saunders, and the Windsor cherry originated by James Dougall. The Ontario apple originated by Chas. Arnold and the Crimson Beauty apple originated by Francis Peabody Sharp are grown to some extent also, as is the New Brunswick apple originated by Mr. Sharp. There are very few fruits of Canadian origin that are grown commercially in Canada, as, in addition to those just mentioned, there are but the Fameuse apple of unknown origin, the McIntosh apple originated with John McIntosh, Dundela, Ont., in 1796, and the Herbert raspberry originated with the late R. B. Whyte, Ottawa, Ont.

It will thus be seen that most varieties of fruits grown commercially in Canada are of foreign origin. This is due to Canada being more recently developed than the United States, Great Britain and Europe, where most of the fruits grown in Canada originated over a long period as chance seedlings. The work of the pioneer fruit breeders in Canada was limited owing to the most of their time being occupied with their main business of making a living.

Since the Central Experimental Farm was established in 1887 continuous effort has been made to originate new varieties of fruits which would be especially suited to Canadian conditions, especial attention having been paid to the apple. When Dr. Wm. Saunders came to Ottawa from London he brought with him a large collection of seedlings of currants, raspberries and gooseberries which he had originated. Some of these have proved of great merit, and after having been thoroughly tested are being introduced. These include the Count and Brighton raspberries, the Mabel gooseberry, and the Kerry, Saunders, Topsy, Magnus and Climax black currants.

Cross-breeding of apples to obtain hardy varieties for the Prairies was begun by Dr. Saunders in 1894, the Pyrus baccata being used to obtain hardiness. Of this work the Osman and Columbia, two crab apples, have shown superior hardiness under trying conditions on the Prairies, and mark a step in advance. These first crosses were re-crossed by Dr. Saunders, and larger fruit from two to two and one-half inches in diameter resulted, and these are now being tested on the Prairie for hardiness.

Work in breeding fruit was begun in the Horticultural Division at Ottawa in 1895, and has been continued since, many promising new varieties of apples having been obtained. Perhaps those which promise to be of greatest value are the open pollinated seedlings of McIntosh, including Melba, Joyce, Patricia, Pedro, and Hume. These are now being propagated for introduction. Whereas when the work was begun there were only three or four varieties of winter apples which had been found hardy, now one hundred or more long keeping sorts originated in the Horticultural Division have lived through test winters.

The Portia strawberry is, perhaps, the best of some very good ones which have been originated. Work is going on with pears, plums, grapes, raspberries, gooseberries, and other fruits.

At the Experimental Station, Vineland, Ont., and at the Ontario Agricultural College, Guelph, Ont., good work is being done in fruit breeding, promising new tender fruits particularly having been originated.

Concerning the C. S. T. A. and Its Branches

By the GENERAL-SECRETARY

APPLICATIONS FOR MEMBERSHIP

Since the publication of our January issue, the following applications for membership in the Canadian Society of Technical Agriculturists have been received:

Cloutier, Henri, (Laval, 1912, B.S.A.), Three Rivers, P.Q.

Coon, H. A. (Queens, 1919, B.A.) S.S.B., Calgary, Alta.

Godbout, A. (Laval, 1913, B.A., 1918, B.S.A.) Ste. Anne de La Pocatiere, P.Q.

Laflamme, A. (Laval, 1918, B.S.A.), Beauceville West P.Q.

Létourneau, A. (Laval, 1916, B.S.A.) Dept. of Agriculture, Quebec, P.Q.

MacKenzie, N. D. (Toronto, 1909, B.S.A.), Exp. Farm, Indian Head, Sask.

Matthews, A. E. (McGill, 1920, B.S.A.) Cloverdale, B. C.

Méthot, Paul, (Laval, 1920, B.S.A.) Dept. of Agriculture, Quebec, P.Q.

Prince, G., (Laval, 1920, B.S.A.) Riviere du Moulin, P. Q.

Landry, Albert (Laval, 1917, B.S.A.)Ste. Therese, P.Q.

Heroux, Albert (Laval, 1917, B.S.A.) Montreal, P.Q.

Gosselin, J. E. (Laval, 1917, B.S.A.) Richmond, P.Q.

These names should be added to the 509 names which were published in our last issue, raising the total membership to 521.

CHANGES IN ADDRESSES.

The following changes should be noted in the addresses of some of our members, as published in our last issue; the addresses here given are correct:

J. E. Britton, Kelowna, B.C.

E. S. Hayter, Demonstration Farm, Killarney, Man.

W. L. MacFarlane, Fox Harbour Point, N.S.

F. Larose, Plantagenet, Ont.

J. A. Ste. Marie, 2 Place Youville, Montreal, P.Q.

G. C. Routt, Agr. Extension Work, Carrolton, Ky., U. S. A.

M. H. Howitt, Macdonald College, P.Q.

C. Lyster, Montreal, P.Q.

E. F. Neelands, Prison Farm, Guelph, Ont.

C. H. Hodge, Family Herald & Weekly Star, Montreal, P. Q.

L. V. Parent, Co-operative Wool Growers, Lennoxville, P.Q.

Osborne Cook, Macklin, Sask.

A. B. Baird, Entomological Laboratory, Fredericton, N. B. J. D. French, 240, Fall St., Seneca Falls, N. Y., U. S. A. J. A. McLean, Fritz Carlton Hotel, Boston, Mass. U. S. A. R. C. Treherne, Entomological Laboratory, Vernon, B. C. Wilfrid Delaney, Papineauville, P. Q. Bruno Chartier, L'Islet, P. Q. J. A. Filion, Plessisville, P. Q. C. A. Fontaine, Institut Agronomique, 16 Claude Bernard, Paris, France. Geo. Gélinas, Hébertville Sta., Lac St-Jean, P. Q. Arthur Lamarre, Drummondville, P. Q. J. L. Langevin, La Malbaie, P. Q. C. M. Learmonth, Dept. of Public Works, Regina, Sask.

If any of our members have changed their addresses, and the address given in the January issue is incorrect, the General Secretary should be notified at once.

MACDONALD COLLEGE NOTES.

(Note.—Reports similar to the following, furnished periodically by the various departments of agriculture and the agricultural colleges, will be gladly published in "Scientific Agriculture," and will be of particular interest to readers of that magazine).

Dr. F. C. Harrison, Principal of Macdonald College, was, in his absence, elected as President of the Society of American Bacteriologists, at their annual meeting held at Chicago, Ill., Dec. 28th., 29th. and 30th., 1920. The Society has a membership of about 1,000. The fact of a Canadian being appointed to the head of an American association is a matter of international interest.

Professor H. Barton left Macdonald College on Jan. 21st., for Ayr, Scotland, where he goes at the invitation of the Ayrshire Cattle Herdbook Society of Great Britain and Ireland, to judge at their fair being held on the 9th. and 10th. of February 1921.

The Biology Department, Macdonald College, has been divided into two Departments:—The Department of Entomology and Zoology, under Professor William Lochhead, and the Department of Botany, under Professor B. T. Dickson.

Mr. Morley A. Jull, M.Sc., Manager and Lecturer in the Poultry Department, is on leave of absence, continuing the advanced work at the University of Wisconsin which he began in the summer of 1919.

Professor Robert Summerby left early in February for Cornell University, where he will undertake advanced studies in Plant Breeding and Soil Management. He will return to the College in time for the opening of the session of 1921-1922.

Dr. G. P. McRostie has been appointed Assistant Professor in the Cereal Husbandry Department of Macdonal College, in charge of grass and clover investigations. Dr. McRostie graduated from the Ontario Agricultural College in 1912, and after serving with the Ontario Department of Agriculture as agricultural representative for a time, took up post graduate work at Cornell University, from which he received the degree of Doctor of Philosophy in 1919. At Cornell he majored in Plant Breeding and Plant Pathology, and did special work in breeding beans for disease resistance.

Mr. Walter Biffen, B.Sc., N.D.D., has been appointed lecturer in the Department of Botany. Mr. Biffen graduated from the University of Wales in 1906 with B.Sc., in agriculture and the following year completed the N.D.D. at Midland College.. For three years he was Research Assistant in the Imperial Department of Agriculture for the West Indies. Later he taught at Aberystwyth University and Tamworth Agricultural College. He will teach part of the courses in Botany at Macdonald College and will also engage in research work.

Pure Seed Distribution and the Method Employed in Alberta

By G. H. CUTLER, Professor of Field Husbandry,
University of Alberta.

(Read before The Western Canadian Society of Agronomy and published through the courtesy of that Society)

In its broadest interpretation seed or plant distribution may be regarded as having been one of the most potent instruments in developing the World's Agriculture. Aided by man and other agencies, useful seeds and plants have been carried even to the remotest corners of the earth. By instinct man in all his nomadic adventures has taken thought of his needs and provided himself with provender and the wherewithal by which he might ensure it. Our most important food plants—the small grains, grasses, legumes and root crops have thus been widely distributed.

Fortunately for the North American farmer, our Federal governments have taken up seed and plant distribution in connection with their plant introduction schemes, in a thoroughly intensive and businesslike manner. From the inception of the Experimental farms system in Canada in 1886, seeds from every clime that seemed even to give only the remotest promise of crop possibilities, were brought to Canada and tried out on all stations and station farms. Later in 1897 the United States Department of Agriculture organized for the same purpose, so that since those dates the earth's surface has, as it were, been combed in search of plant and seed materials that could render a service to the farmers of America.

In an endeavor to make the best use of all plants and seeds thus obtained, our experiment stations have developed extensive plant breeding programs for the improvement of crops. All available plant materials are thereby being utilized in making and remaking suitable crops for the great variety of soils and climate found in the given territories served by the stations. Co-existing with, and as an integral part of all plant breeding programs, is that of seed distribution of improved products.

The writer has introduced the subject in this way in order to emphasize the fact that seed distribution must be an integral part of the machinery of a properly organized plant breeding enterprise, if the constituency is to derive therefrom its full share of the benefits. A hasty backward glance to the earlier efforts of individuals and institutions further reveals this fact. The two veteran English breeders, Patrick Sheriff and Hallett at once claim our attention. The latter especially had his system of distribution so highly developed that those who obtained his improved seeds were urged to return regularly for pure stocks in order to keep up the purity and vigor of the resulting crops.

Vilmorin of France and Rimpau of Germany did signal service to their respective countries by improving sugar beets and rye respectively and making the resulting improved products available to the crop growers at large.

Mention is deserving also of the type of work instituted by the Swedish Seed Association established at Svalof in April, 1886. The primary aim of this association was "by means of careful breeding to seek to produce stock seed of special value and to distribute it throughout the country." This association, although somewhat reorganized, is still continuing to operate along much the same line as in the earlier days of its history.

Seed distribution in America as applied to agricultural colleges and experiment stations, has been in vogue for nearly forty years. To the lasting credit of Prof. C. A. Zavitz, of Guelph, an organization called the Experimental Union was formed in 1886, which had as one of its objects, the testing and multiplying of pure seed produced at the college. So far as we have been able to learn, this is the very earliest attempt of this kind in America to organize farmers into a working force, with the experiment station for purposes of seed testing and multiplication. The station sends out small samples of pure seeds representing new varieties or new hybrids, to the members of the Union, to be tested according to plan, and when these have proven of greater usefulness than the common varieties they are multiplied by the co-operator for his own use and for wide distribution.

The Central Experimental Farm at Ottawa has also followed a system of seed distribution with most gratifying results as is the testimony of farmers. No organization, however, is attempted by the Experimental Farm and very little if any, jurisdiction is exercised over the tests made or the seed resulting. In a like manner nearly every province in the Dominion has developed some form of seed distribution scheme, thus affording a medium by which improved products, the results of selection or breeding, are extended to the farming constituency.

A more modern development is what is called the "Crop Improvement Association." This organization in most cases is patterned somewhat after the Experimental Union. Like the Union, it aims to organize the growers into a definite working force, as a part of the station machinery, but it goes one step further and aids in the multiplication and redistribution of pure seed in a large way. Thus all seed that the station has for distribution is tested out over a wide range of conditions and if suitable, it is rapidly multiplied to find its way into the trade.

In Alberta there has been an insistent demand from farmers for information as to the most suitable varieties for certain districts as well as for pure seed of the best varieties. To meet this situation, it became necessary to institute some scheme by which information could be had as to what varieties and strains should be recommended for different parts of the province and by which pure varieties originated or improved by the University, could be produced in quantity for extensive distribution. Consequenty, to relieve this two-fold need, we have proceeded to form an organization of the Crop Improvement Association type, known as the Alberta Crop Improvement Association. In organizing

ALTASWEDE RED CLOVER.
A new production of red clover being multiplied for distribution. University of Alberta.

this association, the following fundamental principles have been observed:—

1. That organized effort with the growers is essential.

2. That an association with recognized rules and regulations exercises a splendid effect in securing a high standard of work.

3. That pure seeds of good strains, hybrids, etc., produced by the station, must be sent out under the directing authority of the station.

4. That all seed sent out by the station must be of known origin, standing and purity.

5. That all seed sent out should be sold outright—and that the proceeds for same may be regarded as membership to the association.

6. That small tests by growers or members of the association are essential as a means of confirming one's opinion of a given strain.

7. To become an effective agency in the production of pure seed, seed must be supplied to the grower in sufficient quantity to enable the individual to multiply it into saleable quantities in a minimum of time. This makes it possible for the grower to take steps to equip himself with clean land, suitable implements, etc., by which he can make an enterprise out of seed multiplication and distribution.

8. That only a very limited number of farmers are qualified to grow pure seed for distribution.

9. That all seed sent out by the station and produced therefrom, should be standardized according to possible recognized national standards.

10. That all seed growing operations should, in a large measure, be under the jurisdiction of the association management.

11. That a management be appointed to act in an advisory capacity when matters of policy are concerned.

12. That for purposes of preparing seed for sale and selling, a secondary organization might well be developed—this should be of a local character only.

Briefly stated, the Alberta Crop Improvement Association enables the Department of Field Husbandry to extend two important services to the seed growers of the province, viz.,—

1. The co-operative testing and multiplication of new strains, new varieties and new hybrids produced by plant breeding and selection.

2. The multiplication and ultimate distribution of high grade seed of approved strains and varieties of farm crops.

Membership.

Membership consists of two kinds:— 1. Co-operative Experimenters, where the individual tests new seeds for their suitability to local conditions; 2. Seed Growing Centre, where there are at least 5 growers.

To become a member and to retain membership in the Alberta Crop Improvement Association, one must pay cash for all seed obtained. The Co-operative Experimenters, in addition, must forward to the Director at or near the end of each season, a written report on the particular crops he is testing. So long as each member complies with these rules he retains membership, and is advised, from time to time, as to the seed or seeds that the Department of Field Husbandry has available for distribution.

I

Co-Operative Experimentation.

The Department offers to members of the association new and untried strains or hybrids resulting from the systematic improvement of farm crops as carried out by the Department of Field Husbandry. In view of the fact that wheat, oats, barley, winter rye, peas, corn, alfalfa, clovers, timothy and western rye are under-going improvement, the prospects are very bright for immediate service to all members. In fact, already the following new strains are ready for wide distribution and testing:—

One strain of peas (Alberly Blue).
One strain of Red Clover (Atlaswede).
One strain of Corn (Howes Alberta Flint).

In the very near future new strains of wheat, oats and barley will be available.

Conditions under which these tests may be made.

1. The seed is sold at a cash price—money to accompany order.

2. The grower agrees to give a written report of how the resulting crop succeeds.

3. Full specifications will accompany each test indicating the method of procedure in carrying out the experiment.

4. No inspection is given to crops or seed grown from small samples in this way.

UNIVERSITY BANNER.
Elite seed being multiplied for distribution.
University of Alberta.

II

Seed Growing Centre.

For the multiplication and distribution of pure seed, seed growing centres are being arranged at point suitably located throughout the province. The locations of these centres are determined by the following factors:—

1. The suitability of the local conditions for the production of a high quality of clean seed of some one crop.
2. The efficiency of shipping facilities in order that large surpluses may be readily transported.
3. The ability of the growers to do careful work in the production of their seed crops.
4. The possibility of obtaining at least five growers in each centre—exceptions will be made where it seems probable that sufficiently large amounts of seed will result at a relatively small cost to the University.

The working plan is as follows:—

1. Seed of high standing is offered to each member of the association, the seed being Elite or 1st Gen. Registered, representing a suitable variety or strain.
2. The seed is sold at a cash price, to be determined from time to time by the Dept. of Field Husbandry.
3. Sufficient seed is sold to each member to seed a minimum of one acre. This quantity enables the grower to get into seed growing extensively in a minimum of time.
4. The grower contracts to seed it on clean land, rogue it if necessary and thresh it carefully.
5. The University on the other hand, agrees to inspect free of charge the standing crop and threshed grain, according to the rules and standards of the Canadian Seed Growers' Association.
6. All resulting seed passing inspection may be registered by the Canadian Seed Growers' Association. This gives it a recognized standing, not only in all parts of Canada, but the United States as well, a point of supreme importance to the grower.
7. All seed and standing crops are inspected by competent inspectors.

The advantages accruing from this association are as follows:—

The Dept. of Field Husbandry of the University is enabled to place new and improved strains and varieties of all farm crops, produced by scientific breeding and selection, at the disposal of the farming constituency.

The seed growing centre scheme ensures large and regular supplies of registered seed of approved varieties of all crops and places the production of pure seed upon a sound and permanent basis. Accordingly, all farmers in the Province are put in immediate and constant touch with sources of available seed of the highest suitability, quality and purity.

A Tribute to Horticulture

By Prof. V. W. JACKSON, Manitoba Agricultural College, Winnipeg.

At the Horticultural Banquet, Winnipeg, Jan. 19th.

Back in the beginning, three cradles of civilization rocked the children that loved the fruits of the earth. The Mesopotamian cradle swung under the grape vine and the fig tree, and the scent of the peach and the almond was all around. In the far east, the milk of the cocoanut nourished teeming millions of yellow and brown to the age of four, and then banana and pawpaw was bread unto them. On the Earth's other side, the Incas, and Aztecs fed their red ones hominy and potatoes in the Andes of Peru and on the plains of Yucatan.

These cradles in the sun were a big advance on the cave where chilly children chewed raw meat of bones to keep warm. It was man's effort to live in the sun,—to make a garden and live in peace. Horticulture has always meant peaceful culture of the things that please—cooling juices that are a tonic unto the soul, and refreshing herbs that renew thy youth.

H. G. Wells in his Outlines of History shows how the animal in us has been fostered since the cave men beat each other with bones, culminating in 1914 when the "bully beef" of the world was rushed to the front that this world's passion might be appeased. The cattle of a thousand hills were sacrificed to possess the plains of grain. The men of the mountains have always coveted the peaceful valleys and plains below—and there is a dietetic explanation of the peaceful plain. When Ahab coveted Naboth's vineyard, he said "That I may have it for a garden of herbs... near unto my house, and I will give thee for it a better vineyard"—presumably upon the hill. A "garden of herbs near unto the house" is the desire of kings, and who has not enjoyed that royal feeling each returning spring—a desire to get out and do something in the garden,—that adult sandbox where we play at living, and life is the joy of the promise of fruit thereof. It seems then that the best dose for animalism is to "hoe our own row of the thing we like most." One article, and perhaps article one, of the League of Nations lies buried in the garden. Unless a people produce or see the fruits of their labors, they see the sand castles of their youth and the gardens of their playhouse undone, and are dissatisfied and wage war for a better realization of their dreams. Nothing works for peace of mind like work that uses all our powers and directs nature's forces to the fullness of the earth and fruit of all our labors.

This natural, human endeavor to have better fruits to eat is horticulture and one of the biggest factors in civilization. The antiquity of this endeavor is seen in the banana that has forgotten how to make seed, and in the excellence of the grape in Omar's time, and right up to our time and place, the search for better things for our tables, continues.

The potatoes of Portage Plains are known as William Smith's potatoes—a selected strain which has given the best results there; Mr. Boughen has shown what fruits are hardy for the Dauphin district; Mr. Skinner will tell us what plants of N. E. Asia will grow in Manitoba; Prof. Hansen has searched along the Hudson Bay Railway and Peace River for wild fruits for domestication; Mr. Stevenson's experiments with apples at Morden recall pioneer efforts of the Dufours to raise European grapes in Indiana over a century ago; and Adlum's improvement of the native Catawba; and Ephraim Bull's native Concord, which has tickled the palates of millions with its foxy taste.

Yes! There were Stevensons in those early days, and

what we owe to our local horticulturists and enthusiasts can be measured by the states and countries now devoted to the culture of American grapes and native berries.

English gooseberries have gradually increased from 18-36 dwts. each during the last 40 Horticultural Shows. Five native plums and two native cherries have played an important part in the improvement of our "pit" fruits,—now over 300 varieties. A namesake of Mr. Downing who has arranged this unique garden dinner doubled the size of American gooseberries in the Downing variety and saved the famous "Mulberry bush" from the wrath of speculators. Apples have undergone great local improvement. — Rhode Island Greenings, King of Tompkin's county, MacIntosh Reds, etc.

The survival of the fittest is most obvious in Horticulture. The test is direct and simple—from tree to palate; from garden to table. Our likes are strong and our judgment final. Horticulture is anybody's vocation or avocation. It becomes the city as well as the country. The ideal city is a city of back gardens. The common effort of the mass brings forth the good things of life. Potatoes only a century on our tables; but now the world's greatest crop. Carrots, beets, and cabbages have been known only a little over a century; but in proportion as we have found them good have they been improved.

So much for the productive possibilities of horticulture. Its tonic and dietetic value is not less wonderful. The monotonous meat diet of the Middle Ages is subtly expressed in "Mediaeval" the evil of meed,—a sour sop made of stale ale, old bread, meat, and honey. "Four and twenty blackbirds baked in a pie" was "a dainty dish to set before a king." Buzzards, herons, rooks, and eels were prized by common folk, — pease and beans seem to have been about the only vegetables or garden crop; although no doubt, wild green herbs were used.

No wonder the East India Company prospered, and spices were in great demand,—anything to change the tastes of such restricted food was a "sutiltie" and some households spent £125 on spices,—equivalent to $6,000 to $10,000,—all because refreshing fruits and vegetables were unknown to them.

A dietetic revolution has taken place in our time,—an overwhelming victory for fruits and vegetables. Ten years ago, grape fruits were scarcely known,—now every town and village on the prairies receives its weekly consignment of grape fruit. Two carloads of tropical fruits are consumed in Winnipeg each winter's day. Lettuce, tomatoes, and strawberries are arriving daily from Texas. Most of us can recall when tomatoes were called "love apples," a sentimental keepsake—now considered worth 50 cents a pound, worthy of greenhouse care or a 2,000 mile journey.

All arguments against liquor failed until there was something to take its place. I believe that the quite recent remarkable improvements in fruits, and the concomitant improvement in marketing and serving the things we relish, together with the dawning consciousness that a banana split or fruit cocktail was a more dignified and refreshing thing than a schooner of froth or a drop of fire, was the deciding factor in world-wide prohibition.

That society, group, or gathering which fosters the fresh, the pure, and the bountiful,—a garden of herbs near unto the house, is worthy of all help and praise.

EDITORIAL BOARD

It is hoped that when the March issue of "Scientific Agriculture" appears, it will contain the announcement of the Editorial Board that is now being appointed by the Dominion Executive of the Canadian Society of Technical Agriculturists. Considerable progress has already been made, and it is now possible to publish the names of some of those who have consented to act on the proposed Board.

For the Division of Cereal Husbandry the Dominion Cerealist—Dr. C. E. Saunders—and the Secretary of the Canadian Seed Growers' Association—Mr. L. H. Newman—have been appointed. Agricultural Botany will be represented by J E. Howitt, Professor of Botany at the Ontario Agricultural College, and B. T. Dickson, Professor of Botany at Macdonald College. In Entomology, the names of Arthur Gibson, Dominion Entomologist, and Dr. J. M. Swaine, Chief of the Division of Forest Insects in the Dominion Entomological Branch, have been proposed, and both of these officers have consented to act. Dr. F. C. Harrison, Principal of Macdonald College and Professor of Bacteriology at that institution, with D. H. Jones, Professor of Bacteriology at the Ontario Agricultural College, will represent the division of Bacteriology.

From the foregoing it is apparent that the nature of the material published in "Scientific Agriculture" will be decided by men who are eminently qualified to pass upon the merits of papers submitted for publication. In addition to the divisions of Cereal, Husbandry, Botany, Entomology and Bacteriology, there will be two men appointed for each of the following divisions of Agricultural Science: Animal Husbandry, Chemistry, Dairying, Economics and Sociology, Genetics, Horticulture and Veterinary Science. In some of these divisions one appointment has already been made, and it is presumed that all of those whose names are under consideration, will have agreed to act before the March issue is printed.

Attention was directed in the first issue of this magazine to the importance of an Editorial Board, and every effort has been made in the selection of names and the

other preliminary work involved, to have the Board appointed quickly, and to select men whose qualifications are unquestionable. There has been considerable difficulty in obtaining sufficient material, of a desirable nature, to turn out a creditable publication in January and February, and that difficulty is likely to continue until men who are in close touch with the work being done in their respective fields of effort, give their support to the magazine. It would be a serious misfortune if the present policy of those responsible for "Scientific Agriculture," namely, the Canadian Society of Technical Agriculturists, should have to be modified on account of lack of support on the part of those who are in a position to contribute original material. The appointment of an Editorial Board should help to relieve the present difficulty, and ensure the appearance in this new technical magazine, of only such articles and general material as will be creditable to the Society which it represents.

Every member of the Canadian Society of Technical Agriculturists should feel it his personal duty to support this magazine in every possible way, and one of the most important methods of support is the prompt contribution to the Editor of any material suitable for publication. Many readers, outside of the Society, can give similar assistance. And, for the next month or two, the men who constitute the Editorial Board should make a special effort to prevent that most serious of all situations — a dearth of material.

QUEBEC SOCIETY FOR THE PROTECTION OF PLANTS.

The thirteenth annual meeting of the above society is being held in the Biology Building of Macdonald College on Tuesday March 1st, 1921, opening at 2 P. M. There will be afternoon and evening sessions. Among the more important papers and addresses which will be given, the following have been noted:

Protective Seed Treatment, by G. Maheux, Provincial Entomologist;

The Larch Aphis, by Dr. J. C. Chapais;

Chemical Investigations of Sprays, by A. Kelsall;

Insect Pest Legislation, by L. S. McLaine; Dominion Ent. Branch;

Breeding for Disease Resistance in Plants, by Dr. G. P. McRostie;

Teliospore Germination in P. antirrhini, by J. F. Hockey;

Fungous Diseases of 1920-21, by Prof. B. T. Dickson;

Observations on the Potato Plant—Louse, by Omer Caron;

Bird Allies (illustrated), by Prof. W. T. MacClement, M.A., D. Sc. of Queen's University;

Present Status of Plant Pathology in Agriculture, by Prof. H. H. Whetzel of Cornell University;

Addresses will also be delivered by Prof. W. Lochhead of Macdonald College, Mr. Arthur Gibson, Dominion Enthomologist and Dr. F. C. Harrison, Principal of Macdonald College.

The much discussed question of spraying versus dusting of orchards will be introduced by Mr. C. E. Petch of Hemmingford, P. Q.

It is probable that a number of the papers given at this meeting will be published in the March issue of Scientific Agriculture.

Agricultural Production in the Province of Quebec
Production Agricole dans La Province de Québec

COMPARISON BETWEEN 1911 AND 1920—COMPARAISON ENTRE 1911 ET 1920

Field Crops—Récoltes des Champs

	1911 Superficie ensemencée Area seeded acres	1911 Production Yield boisseaux bushels	1911 Valeur Value	1920 Superficie ensemencée Area seeded acres	1920 Production Yield boisseaux bushels	1920 Valeur Value
Blé Wheat	68,999	1,223,000	$ 1,443,000	222,045	4,163,000	$ 8,456,000
Avoine Oats	1,430,209	37,500,000	19,875,000	2,205,908	66,729,000	58,722,000
Seigle Rye	12,735	200,000	202,000	28,462	534,000	1,004,000
Orge Barley	99,762	2,271,000	1,771,000	194,444	4,910,000	6,923,000
Pois Peas	32,507	517,000	708,000	60,870	1,035.000	3,478,000
Fèves Beans	6,065	114,000	225,000	35,835	645,000	2,632,000
Sarrasin Buckwheat	112,880	2,548,000	1,886,000	151,765	390,800	5,393,000
Grains mélangés Mixed grains	114,347	2,925,000	2,018,000	143,423	4,195,000	5,286,000
Lin Flax	1.146	13,000	22,000	16,035	184,000	657,000
Maïs à grains Corn for husking	23,473	712,000	719,000	47,741	1,420,000	2,258,000
Pommes de terre Potatoes	124,381	15,763,000	10,561,000	310,692	57,633,000	57,633,000
Plantes-racines Roots	13,543	3,943,000	1,459,000	83,613	27,530,000	13,765,000
		Tonnes Tons			Tonnes Tons	
Foin et trèfle Hay and Clover	3,294.230	6,260,000	63,664,000	4,290,121	5,363,000	155,527,000
Maïs fourrager Fodder Corn	37,155	325,000	1,560,000	86,833	695,000	7,089,000
Luzerne Alfalfa	3,634	14,000	135,000	28,200	68,000	1,428,000
		lbs			lbs	
Tabac Tobacco	12,094	10,095,901		33,000	26,400,000	6,600,000

Total area seeded in 1911 .... 5,480,673 acres .... Superficie totale ensemencée en 1911
— — — in 1920 .... 7,905,987 acres — — — en 1920
Total value of field crops ...... $ 65,353,528 .... 1911 ...... Valeur totale de la récolte
— — — — — 330,251,000 .... 1920 ...... — — — —

Province of Quebec—Province de Québec

Dairy Industry—Industrie Laitière

	1911	1920
Butter Beurre	41,782,678 lbs valued at $9,961,732	37,681,366 lbs valued at $20,857,523
Cheese Fromage	58,171,091 lbs valued at $5,695,254	58,044,719 lbs valued at $15,305,488

The Department of Agriculture of Quebec main tains forty-three District Representative offices.

La Revue Agronomique Canadienne

Section Française de l'Organe Officiel

DE LA

Société des Agronomes Canadiens

Rédacteur: F. Létourneau.

Les Nouvelles Techniques

Aux époques primitives de l'agriculture, le sol et le climat sont les deux facteurs dominants de la production; l'homme se borne d'abord à cueillir des fruits sauvages, et c'est un stade de l'évolution agricole qui se mesure peut-être par milliers d'années; il ne commence à devenir un cultivateur qu'au moment où il apprend à préparer le sol et à semer pour récolter ce que la terre, la pluie et le soleil ont bien voulu faire naître des grains qu'il leur a confiés. Malgré quelques perfectionnements, amélioration des labours, sarclage des mauvaises herbes, épandage de faibles quantités de fumier, on peut considérer que cette pauvre culture est celle qui se pratiquait encore au XVIIIe siècle, au moins d'une façon générale. L'agriculture moderne s'est constituée au cours du XVIIIe siècle, ou plutôt dans sa seconde moitié, quand on a appliqué les découvertes des physiologistes, des chimistes et des physiciens sur les conditions du développement des plantes.

La terre ne produit pas les récoltes qu'on lui arrache sans se fatiguer et s'appauvrir. Elle éprouve comme les êtres vivants les efforts du surmenage et de l'usure. Dans le système primitif de l'exploitation, on avait reconnu la nécessité de laisser reposer la terre épuisée; une année sur quatre, les champs restaient en jachère. Même en se privant ainsi d'un quart du territoire agricole, les cultivateurs ne pouvaient rendre aux terres toute leur fertilité; les éléments chimiques qui ont été absorbés par les plantes ne se reconstituent pas spontanément dans un laps de temps aussi court. Le système rationnel de culture consiste, aujourd'hui que la science a déterminé exactement les éléments qui sont nécessaires à la végétation (azote, phosphore, potasse, chaux, etc.), à lui rendre les éléments qui lui manquent. A l'agriculture épuisante qui, par l'épandage du fumier de ferme, ne rapportait à la terre qu'une restitution, le plus souvent insuffisante, a succédé un système de culture scientifique dans lequel le cultivateur reconstitue la fertilité du sol ou même l'augmente par des apports appropriés d'engrais chimiques.

Maintenir la terre dans un état de fertilité constante, tel est donc le premier résultat de l'emploi méthodique des engrais chimiques. Il en est un autre dont l'importance est aussi considérable, c'est que le cultivateur peut modifier la nature du sol en vue d'une culture déterminée, toutes les plantes ne demandant pas pour leur développement la même proportion des éléments nécessaires à la nutrition végétale.

Les engrais chimiques font plus que de restituer au sol ce que les récoltes lui ont enlevé; ils permettent de l'améliorer, et, par suite, d'accroître sa production. A des doses d'engrais croissantes, jusqu'à un certain point, correspondent des récoltes plus abondantes. Toutefois on constate dans la pratique que les apports d'engrais ne peuvent pas être indéfiniment accrus avec avantage. Au delà d'une limite qui varie pour chaque terre, pour chaque sorte de culture et suivant la composition des engrais, la production n'augmente plus proportionnellement, soit qu'il se produise des accidents de végétation, soit que le gain supplémentaire obtenu se trouve, tous comptes faits, inférieur à l'augmentation des dépenses. C'est la loi bien connue du rendement non proportionnel.

Dans l'agriculure comme dans l'industrie, le travail à la main peut être plus achevé, plus soigné, mieux "fini" que le travail des machines. Mais son rendement est faible, et, par conséquent, son emploi est coûteux. Dans les exploitations modernes, où l'on cherche à réduire le prix de revient, la bêche est remplacé par un outillage dont la diversité répond à tous les besoins. Les charrues à un ou plusieurs socs, tirées par des animaux ou actionnées par des moteurs, les sacrificateurs, les herses, les sarcloirs, etc., ont été perfectionnés. Leur travail rapide permet de multiplier les façons culturales et de donner au sol toutes les préparations que la science agronomique considère comme les plus favorables.

Un certain degré d'humidité de la terre doit être maintenu pour assurer la prospérité des plantes. L'agriculteur a appris à délivrer ses terres de l'excès d'humidité par le drainage et à combattre la sécheresse par les irrigations.

L'agriculture moderne a trouvé enfin un moyen d'action efficace dans l'amélioration des espèces cultivées, dans les procédés de sélection. Elle dispose de semences très variées, utilisables dans les divers terrains et donnant des produits qui, par leur qualité ou leur rendement, sont supérieurs à ceux que l'on récoltait autrefois.

Les méthodes de sélection ont été appliquées aussi aux animaux. On est parvenu à créer et à maintenir des races qui se différencient par leurs qualités permanentes. Il y a des chevaux de trait ou des chevaux de course: l'élevage des bovins se fait, soit en vue de la boucherie, soit en vue de la laiterie, soit en vue du travail. Les importations d'animaux nouveaux, les croisements, une alimentation méthodique ont modifié et profondément diversifié la population de nos étables et de nos basses-cours.

Tels sont les principaux aspects de l'agriculture moderne.

L'Enseignement Agricole Officiel en France

G. WERY, Dir. de l'Institut National Agronomique.

C'est la loi du 2 août 1918 qui, après les Lois de 1848 et 1876, régit aujourd'hui la matière. Elle comprend immédiatement deux grandes divisions: l'enseignement aux jeunes gens, l'enseignement aux jeunes filles et, dans chacune de ces divisions, un enseignement post-scolaire agricole.

D'après l'article 1 de la Loi, les jeunes gens reçoivent l'enseignement agricole dans les établissements suivants:

1) à l'Institut National Agronomique qui est l'Ecole Normale Supérieure de l'Agriculture. Il reçoit des élèves hommes et femmes;

2) dans les Ecoles Nationales d'Agriculture de Grignon, Montpellier et de Rennes;

3) dans les Ecoles d'Agriculture qui comprennent:

a. les Ecoles pratiques,

b. les Fermes-Ecoles,

c. les Ecoles techniques dont l'enseignement a pour objet une spécialité agricole,

d. dans les Ecoles d'Agriculture d'hiver ou saisonnière,

e. dans les cours d'enseignement agricole post-scolaire.

L'Institut National Agronomique

L'Institut National Agronomique, établi à Paris, 16, rue Claude Bernard, donne surtout à ses élèves l'enseignement scientifique appliqué à l'agriculture dans ce qu'il y a de plus élevé. Son enseignement procède de cette idée qu'il est matériellement impossible de donner, à la fois, dans le même lieu et dans le même temps, la Science dans sa plus haute expression et la pratique du métier.

Etabli à Paris, il dispose des avantages que l'on trouve réunis dans les grandes villes: professeurs éminents, collections bibliothèques, facilités particulières pour les recherches.

L'Institut Agronomique, grâce à des arrangements conclus avec un grand propriétaire des environs de Paris, a un champ de démonstration pour ses élèves. Ceux-ci apprennent à y reconnaître les différentes plantes et leurs variété, l'effet des engrais, etc. En outre, ils suivent, de temps en temps, les travaux de la ferme à laquelle il est attenant. Ils font tout l'été de nombreuses excursions dans les belles exploitations agricoles qui abondent autour de Paris. Pendant leurs vacances qui s'étendent du 15 juillet au 15 octobre de chaque année, ils doivent séjourner au moins deux mois dans une ferme, rapporter un journal attestant qu'ils ont suivi chaque jour les opérations culturales et un mémoire sur un sujet agricole déterminé ou une monographie de l'Exploitation.

Avant d'entreprendre la gestion d'un domaine, ils doivent faire un stage d'un an au moins non pas dans une ferme de l'Etat où la culture a toujours quelque chose d'un peu artificiel, mais dans une exploitation indépendante.

Il ne s'agit pas, d'ailleurs, pour l'élève de l'Institut Agronomique de savoir conduire une charrue, quoique cette technique ne soit pas à dédaigner, loin de là, mais surtout de savoir organiser l'entreprise, régler les assolements, apprécier la nature et les doses convenables des engrais, les meilleures variétés de plantes, etc., conduire les ouvriers, etc.

La durée des études de l'Institut Agronomique est de 2 ans. Les élèves n'y sont admis qu'à la suite d'un concours dont les conditions sont assez sévères. Un certain nombre de places sont réservées aux jeunes étrangers qui concourrent entre eux. Durant leurs deux ans de séjour à l'Ecole ils subissent une longue série d'examens et d'épreuves. Ceux d'entre eux qui ont obtenu une note moyenne suffisante reçoivent à leur sortie le diplôme d'**Ingénieur Agronome.** Les deux premiers de la liste de classement peuvent obtenir une mission d'études de 3 ans; les mieux classés à la suite sont admis dans les laboratoires pour se perfectionner.

Les professeurs sont tous spécialisés. Autant de disciplines distinctes dans l'enseignement, autant de maîtres spéciaux. Cette division dans les travaux et les capacités des maîtres, la sélection des élèves qui résulte du concours d'entrée, assurent à l'enseignement et au diplôme d'Ingénieur Agronome des qualités que l'on ne rencontre peut-être pas chez les établissements similaires des autres nations.

Les matinées sont consacrées aux leçons. Il y en a deux en moyenne par jour, d'une durée 1 heure ½ chacune. Les après-midi sont réservés aux exercices pratiques.

L'enseignement comporte un très grand nombre d'exercices dans les laboratoires de Chimie, Botanique,

M. J.-N. PONTON, rédacteur du Bulletin des Agriculteurs, deuxième vice-président de la Société des Agronomes Canadiens.

Zoologie, Géologie, Physique, Hydraulique agricole, Génie Rural et l'examen attentif des collections. C'est surtout à l'issue des deux années d'études, qui sont très chargées, que les élèves les plus qualifiés par leurs aptitudes et leurs goûts peuvent s'initier à la Science. Nous avons dit qu'ils étaient admis à travailler dans les laboratoires sous la direction de leurs maîtres. C'est là où peut se former cette pépinière de jeunes agronomes dont tous les pays auront de plus en plus besoin. Il est à souhaiter que l'Institut Agronomique dispose de ce côté de larges moyens et que ceux de ses élèves qui voudraient se diriger dans cette voie reçoivent des encouragements matériels et moraux suffisants pour s'y engager et y rester.

Aux **Ecoles Nationales d'Agriculture** de Montpellier, Grignon et Rennes sont annexées des Exploitations Agricoles où les élèves peuvent prendre un contact direct avec l'Agriculture. Elles donnent un enseigne-

ment général mais l'orientent cependant vers l'Agriculture de la Région où chacune d'elles est placée: Montpellier, culture des régions méridionales; Rennes, Agriculture de l'Ouest de la France; Grignon, Cultures du Nord de la France et du Centre.

Les **Ecoles pratiques d'Agriculture** sont surtout destinées aux fils de petits cultivateurs. Installées sur des exploitations agricoles, elles donnent à leurs élèves à la fois l'enseignement théorique et l'enseignement pratique, une moitié du temps environ étant consacré aux leçons, l'autre moitié aux travaux de la ferme auxquels les élèves doivent participer directement. On compte actuellement 33 Ecoles pratiques d'Agriculture.

M. JULES SIMARD, du Service Fédéral des Semences, président de la Section de Québec et délégué de la Province au conseil exécutif national de la Société des Agronomes Canadiens

Les **Fermes-Ecoles** dont l'origine remonte à la Loi sur l'enseignement de 1848, se placent, au point de vue de l'enseignement théorique à un niveau un peu inférieur à celui des Ecoles Pratiques, mais l'apprentissage du métier y est plus développée.

Des **Ecoles Spéciales,** de laiteries, par exemple, complètent de vaste réseau d'Etablissements d'enseignement.

Tous les jeunes cultivateurs ne peuvent se déplacer et quitter les travaux des champs pour aller dans les Ecoles d'Agriculture. La loi nouvelle met à leur disposition l'enseignement des **Ecoles d'Hiver** ou **saisonnière.**

Enfin, la loi prévoit un **enseignement agricole postscolaire** qui pourra être donné, durant quatre ans aux jeunes gens âgés de 13 ans.

L'enseignement destiné aux jeunes filles comprend un enseignement agricole proprement dit qui sera donné, d'après la Loi, à l'Institut Agronomique et dans les Ecoles Nationales d'Agriculture: et un enseignement agricole ménager qui sera donné dans des écoles spéciales dites Ecoles Ménagères agricoles. Elles seront permanentes, temporaires ou ambulantes.

Enfin, la Loi du 2 août 1918 prévoit, comme pour les garçons et dans les mêmes conditions, un enseignement ménager postscolaire.

L'enseignement agricole donné aux jeunes gens et aux jeunes filles qui se destinent à l'agriculture est complété par un enseignement qui diffuse les bonnes méthodes, les découvertes et la science parmi les cultivateurs et les cultivatrices. Cet enseignement est assuré par les Directeurs des services agricoles et les professeurs spéciaux d'Agriculture.

Nous possédons, par conséquent, en France, un enseignement agricole bien adopté aux besoins du pays. La loi récente du 2 août 1918 prévoit son complet développement.

NOS AMIS NOUS ECRIVENT...

J'augure beaucoup de bien de votre association des techniciens. Tous les diplômés en agriculture devraient en faire partie. Ils se sentiront ainsi moins isolés et plus soutenus. Ils pourront se mieux connaître, se conseiller, s'entr'aider. Un lien plus étroit s'établira entre tous ces hommes d'une même profession, caressant les mêmes espérances, travaillant dans un même but.

Les médecins, les avocats, etc., ont leur association. Pourquoi les techniciens agricoles n'auraient-ils pas la leur?

Vos réunions fourniront une excellente occasion d'étudier les divers problèmes agricoles et établiront une co-opération plus étroite pour l'avancement de l'agriculture dans notre province et dans le Canada tout entier.

L'agriculture organisée! C'est ce que nous devons désirer pour notre province. Et il n'y a pas de raison, ce me semble, pour que son organisation ne soit pas aussi parfaite que celle du travail ou de l'industrie.

Je souhaite donc longue vie à votre association. Que l'entente cordiale y règne toujours pour le plus grand bien de chacun et de tous, pour la prospérité de l'agriculture dans notre province et le Canada entier.

Bien à vous,

NOEL PELLETIER, Ptre.,
Directeur de l'Ecole d'Agriculture de Sainte-Anne de la Pocatière.

La science agronomique est en perpétuel enfantement et le progrès d'aujourd'hui peut être détrôné par le progrès de demain. Une nation agricole qui s'immobiliserait dans le "statu quo" de la pratique courante même la plus parfaite serait vite distancée par celles qui ne se lassent pas d'étudier et de fouiller tous les mystères de la nature pour en dégager des lois nouvelles.—Jules Méline.

Jamais la question agricole n'a été plus compliquée au Canada que de nos jours, et jamais elle n'a exigé de la part de ceux qui doivent s'en occuper, autant d'études, autant de recherches, autant de compétence et de jugement.—Arthur Sauvé.

Le Ravageur Importe Du Maïs

GEORGES MAHEUX, Entomologiste provincial, Québec.

Les légions des ennemis des plantes cultivées s'augmentent chaque année de nouvelles recrue. Favorisés par la multiplicité des échanges commerciaux ces facteurs de destruction viennent s'échouer sur nos rives et, en peu de temps, établissent sur des bases solides leur très mauvaise réputation. Du reste, il est d'observation constante que les insectes provenant de contrées plus tempérées que la nôtre se livrent chez nous à leur oeuvre néfaste avec une récrudescence incroyable. Pareil phénomène d'adaptation s'accomplit selon des lois biologiques encore mal définies; mais il semble indiscutable que les formes entomologiques subissent l'influence accélératrice d'une saison de croissance raccourcie par ses deux extrémités et qui imprime aux cellules végétales un élan tel que les plantes agricoles réussissent à parcourir tous leurs stages de développement en une période si restreinte. Le ravageur importé du maïs (Pyrausta nubilalis) Hubner) refait ici l'aventure encore toute fraîche de la Spongieuse et du Bombyx cul-doré. Ses progrès étonnants tiennent évidemment de la nature des fléaux qui s'abattirent jadis sur les Egyptiens.

C'est en 1917 qu'on découvrit cet insecte au Massachusetts. Aujourd'hui, il s'est établi dans plusieurs sections de l'Etat de New-York où il cause des ravages immenses, comme le prouve la récente étude de l'éminent entomologiste de cet état, le Dr. E. P. Felt. Le danger est d'autant plus imminent pour le Canada que cet état est limitrophe; et c'est aussi ce qui explique le fait que l'on a trouvé des spécimens de Pyrausata nubilalis Hubner dans quelques localités du sud de l'Ontario au cours de l'été 1920. L'ennemi est entré subrepticement dans la place. La ligne de conduite de tous ceux qui s'intéressent à l'avancement de l'agriculture — et c'est le cas des lecteurs de cette revue — est toute tracée: empêcher l'extension du fléau et immuniser en quelque sorte les régions encore indemnes. Les autorités fédérales et provinciales useront des mesures les plus efficaces pour atteindre cette fin; mais si chaque agronome veut bien prêter main-forte aux entomologistes, en rapportant le moindre cas d'infection, le travail de répression et de prophylaxie n'en sera que plus complet. C'est pour mettre les agronomes et cultivateurs à même de reconnaître cet insecte au cours de leurs observations que nous donnons ici, en un résumé succint, les caractéristiques de la larve et de l'adulte.

Fig 1.—**Ravageur importé du maïs:** a-papillon adulte; b-plaque d'oeufs sur l'envers des feuilles; c-fleur brisée et traces de vermoulure; d-épis infestés; e-tige attaquée et amas de vermoulure; f-le ravageur dans la tige; g-chenilles hivernant dans les débris et portions de tiges; h-pupe dans une tige (D'après Snodgrass.).

L'insecte se nourrit de diverses plantes: maïs sucré, maïs à grain, maïs fourrager, pommes de terre, poiré, betteraves, haricots, céleri, épinards, dahlias, glaïeuls, reine-marguerite et de plusieurs hautes herbes. La plante préférée reste le maïs et les autres ne sont souvent infestées que par suite du voisinage d'un champ de maïs.

L'insecte hiverne à l'état de chenille dans les éteules ou les tiges de maïs. On reconnaît sa présence à des orifices circulaires mesurant environ un huitième de pouce de diamètre et s'ouvrant sur des galeries irrégulières dont la longueur va de un à plusieurs pouces. Orifices et galeries sont généralement obstrués par des cylindres de vremoulure. On trouve dans ce couloir une chenille gris-jaunâtre de trois quarts de pouce de

longueur dont le corps est parsemé de minuscules taches brunes. Ces chenilles prennent leur livrée de papillon à la fin de mai ou au commencement de juin. Insectes nocturnes, ils ne volent que dans l'obscurité et déposent leurs oeufs sur l'envers des feuilles de maïs. Les jeunes larves rongent quelque peu la feuille, puis, poussées par la faim se dirigent vers la tige. Les effets de leur travail de mineur se font bientôt sentir: c'est la rupture de la fleur à sa base; c'est encore la canalisation de la tige sur une portion plus ou moins considérable de sa longueur, selon le nombre de chenilles qui y cohabitent. Le ravageur n'épargne rien; on a trouvé jusqu'à quinze grosses chenilles dans un même épi. Partout où pénètre le foreur les mêmes symptômes se présentent et sautent aux yeux de tout observateur: c'est toujours ces excrétions brunâtres longueur de trois-quarts de pouces à maturité, couleur gris-jaunâtre, robe tachée de minimes points bruns; ajoutons que la tête est brune et que le corps porte des bandes longitudinales indistinctes aux tons rougeâtres ou noirâtres. Des petits tubercules brunclair agrémentés d'un ou plusieurs poils courts et raides permettent de distinguer cette espèce de tous les autres foreurs lépidoptères. Du reste, c'est le seul insecte qui creuse indifféremment toutes les parties, s'attaque à tous les organes et qui grignotte même les grains des épis. (Voir figures 1 et 2.)

Jusqu'à présent on n'a pas rencontré ce fléau dans la province de Québec, rien ne prouve toutefois qu'il ne soit installé en quelques endroits isolés. Au surplus, la menace d'une invasion subsiste toujours.

C'est pour la prévenir que nous demandons le con-

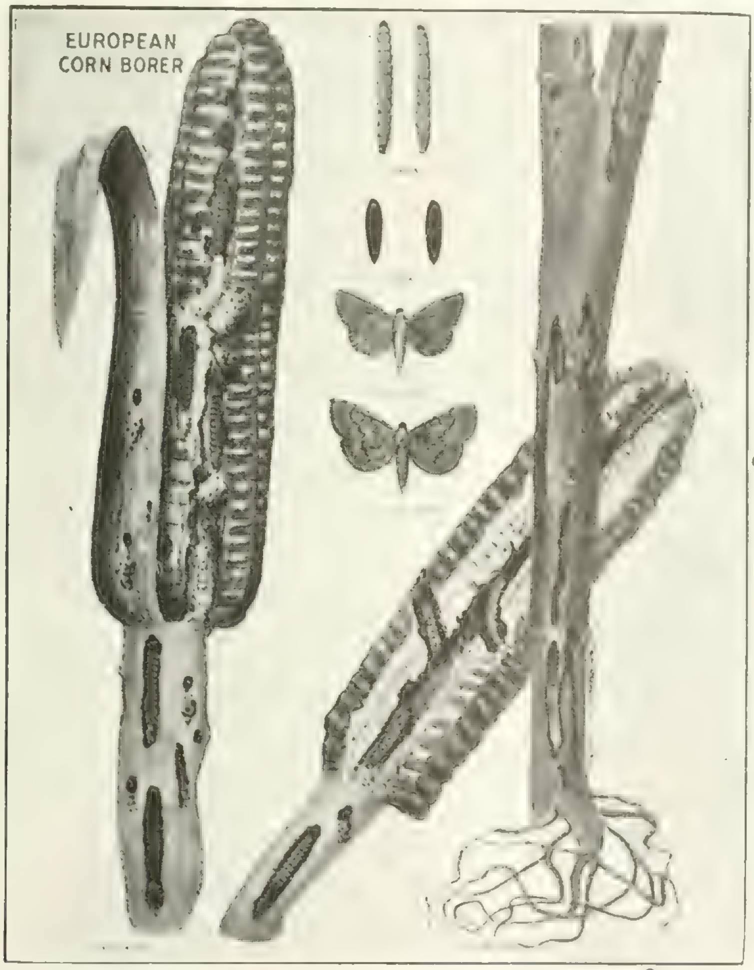


Fig. 2 Cycle vital du Ravageur importé du maïs d'après une affiche en couleurs publiée par la Com. Agr. du Mass.

qui font saillie au point d'entrée des canaux ou qui pendent ici et là le long de la tige. Cette première génération creuse ainsi pendant une quarantaine de jours. Les adultes de la seconde génération font leur apparition vers le premier août, ou un peu plus tard à mesure que l'on avance vers le nord. Les chenilles issues de ces adultes sont responsables des plus forts dégâts; elles forent sans relâche jusqu'aux froids et passent l'hiver dans leur enveloppe larvaire pour ne se transformer qu'au printemps suivant. Il est probable que chez nous le développement sera quelque peu ralenti par les facteurs écologiques particuliers à notre région; toutefois, cela n'empêchera pas le ravageur de parfaire son oeuvre néfaste.

Nous avons donné quelques précisions sur la larve:

cours de toutes les bonnes volontés afin d'être en mesure de tuer dans l'oeuf le fléau s'il franchit jamais les limites de notre province.

Comme l'insecte peut être rapidement disséminé par l'intermédiaire des échanges commerciaux, épis et tiges surtout, le ministère de l'agriculture d'Ottawa vient de décréter le régime de la quarantaine pour certains cantons des comtés de Welland, Haldimand, Oxford, Huron, Elgin, Middlesex et Kent, dans la province d'Ontario. En vertu de cette mesure, il est défendu d'exporter en dehors des cantons énumérés dans le règlement, toute partie de plant de maïs pour quelque fin que ce soit. Il y a quelques exceptions couvrant certains cas où on est moralement certain de l'absence du ravageur.

Un proverbe assure que "la vigilance de tous les instants est le prix de la liberté." C'est une vérité qui s'applique dans le présent cas. Il faut user d'une continuelle vigilance si nous voulons préserver le pays de ces hôtes malfaisants, de ces "indésirables" à tous les points de vue. Sachons, par une co-opération efficace des intelligences, conserver à nos plantes "la liberté de croître". Il y va de l'intérêt de tous, n'y aurait-il que le maïs en cause. En effet, la culture du maïs à grain et du maïs fourrager a atteint en 1920 une valeur de $60,294,400 pour tout le Canada, avec une superficie ensemencée mesurant 880,626 acres. Dans la seule province de Québec, on cultive le maïs sur une superficie de 134,574 acres; la valeur de la récolte se chiffrait l'an dernier à $10,000,000, soit près du trentième de la valeur globale des produits de la ferme. Une telle source de revenus mérite protection. A la lumière de ces faits, nous espérons pouvoir enrégimenter dans une vaste campagne de surveillance tous les lecteurs de la Revue Agronomique Canadienne.

L'Argent Dépensé pour l'Agriculture

L'ingérence de l'Etat dans le domaine économique n'a pas toujours des conséquences heureuses. Dans nombre de cas, cependant, les gouvernements des pays en dépensant des sommes d'argent peu considérables, ont déterminé la création de vastes sources de revenus. En agissant avec prudence, ils peuvent améliorer l'industrie agricole d'une manière incalculable. Pour s'en convaincre, il n'y a qu'à lire une étude parue dans la livraison de novembre du "Journal of the American Bankers Association," et due à la plume de M. Edwin T. Meredith, secrétaire du département de l'agriculture des Etats-Unis.

Les capitaux engagés dans l'industrie agricole chez nos voisins sont énormes. En fait, ils sont aussi considérables que les capitaux placés dans les chemins de fer, toutes les manufactures, le mines et les carrières des Etats-Unis. On les estime en chiffres bruts à 80 milliards de dollars, produisant environ chaque année une récolte estimée à 25 milliards de dollars. Aussi le département de l'agriculture a-t-il fort à faire pour encourager de nouvelles méthodes, introduire de nouvelles semences et combattre les maladies des plantes et les insectes qui détruisent les moissons. Et comme on va le voir, ses dépenses sont compensées sans peine par les résultats qu'il obtient. Ainsi, il a dépensé $250,000 pour faire adopter aux cultivateurs américains le blé "Dorum", aujourd'hui la valeur de la récolte annuelle de cette sorte de blé est estimée à $50.000,000. Il a dépensé $200.000 pour introduire en Californie la culture du riz; l'an passé, la récolte de ce produit était estimée à $21,000,000. Il a dépensé pour persuader aux cultivateurs de la région du sud-ouest des Etats d'adopter la culture du coton égyptien la somme de $40,000; ces régions produisent maintenant pour $20,000,000 de coton par année. Des spécialistes travaillant sous sa direction ont découvert un serum pour prévenir une sorte de choléra qui s'attaquait à l'espèce porcine; ils ont ainsi empêché des pertes de $40.000,000 par année et qui s'élèvent encore aujourd'hui à $60,000. Dans quelques Etats du Sud le sol n'était pas propice à la culture du blé. Moyennant quelques milliers de dollars, le département de l'agriculture y a introduit la culture du sorghe qui est maintenant une source de richesses. Une autre dépense de $564.000 consacrée à la protection des animaux a sauvé aux éleveurs la somme de $6.000,000 environ.

Mais le gouvernement des Etats-Unis n'est pas le seul à aider l'agriculture. L'association des banquiers a propagé la culture d'une variété de melons en y engageant des capitaux considérables sous forme de prêt. Aujourd'hui cette culture s'est répandue et les bénéfices que les fermiers américains en retirent se chiffrent par millions.

Les banquiers ont encore engagé des sommes considérables dans les travaux de drainage et d'irrigation, dans l'établissement de manufactures pour l'extraction du sucre de betteraves. Une chose manquait cependant: les fermiers ne pouvaient obtenir des banques les crédits qu'ils désiraient, aux conditions voulues. Le congrès intervint et passa une loi connue sous le nom de "Federal Farm Loan Act", il y a quatre ans. Cette loi a pour but de permettre aux fermiers d'obtenir des prêts à des conditions faciles sur hypothèque de leur propriété, moyennant un intérêt raisonnable et à des conditions de remboursement faciles. L'opération de cette loi est bienfaisante et a produit de bons résultats.

M. Meredith cite quelques exemplaires qui tendent tous à la même conclusion: une dépense intelligente de quelques milliers de dollars faite par le gouvernement en faveur de l'agriculture rapporte à la nation jusqu'à 2,000 p.c. et plus de bénéfices et de produits, par année seulement. Elle décuple les richesses de la nation par progression géométrique. On ne peut trouver nulle part un capital mieux placé et qui rapporte d'aussi énormes bénéfices, qui cause d'aussi rapides progrès dans le développement national. Les bénéfices nets ne sont pas aussi considérables, car chaque fermier est obligé d'engager du capital et des terres dans l'exploitation. Mais, le chiffre des affaires étant plus que centuplé, les profits le sont également.

Léo-Paul DEROSIERS.

Du "Devoir."

LE SALUT PAR LA TERRE

C'est en vain qu'on cherchera la solution du problème social et économique ailleurs que dans un retour à la terre. Qu'on se le tienne pour dit, à moins d'aller demander au sol le salut, notre race périra, et il n'est pas besoin de s'abandonner à de longues considérations pour s'en convaincre. La question sociale est l'étude des moyens de soulager les miséreux et d'établir l'équilibre entre les classes de la société. Or, ne croit-on pas que, lorsque chacun aura son coin de terre, quand chacun sera assuré de sa subsistence, et de celle de sa famille, la question sociale ne sera pas à demie résolue? Et quand des milliers de bras remueront la terre pour lui faire rendre à sa pleine capacité, ne croit-on pas que le problème économique, qui est surtout un problème financier, ne sera pas résolu?

Hon. J.-E. PERREAULT,
Ministre de la colonisation de la province de Québec.

Les Stations Agronomiques en Allemagne

Les stations agronomiques de l'Allemagne, au nombre d'une soixantaine, institutions des Etats fédérés, sont spécialisées; parsemées à travers les diverses régions, elles étudient et préconisent les meilleurs procédés de culture dans les sols qui les environnent.

Vers 1890, une découverte sensationnelle sortit de la station agronomique de Bernbourg, en Anhalt. Les professeurs Helriegel et Wilfarth avaient trouvé et cultivé le ferment qui permet à la luzerne d'absorber l'azote atmosphérique, en 1893, je me rendis auprès deux, accompagné dun grand agronome français; nous leur demandâmes s'ils poursuivaient leurs recherches sur ce sujet.

"Non, dirent-ils, car ce n'est pas notre mission; nous avons fait cette découverte au cours d'autres expériences, mais nous sommes chargés d'étudier tout ce qui touche à la betterave à sucre, principale culture du duché d'Anhalt, et nous n'avons pas le droit d'abandonner ce programme pour un autre."

A Brême, existe une station qui, depuis trente ans, ne s'occupe que de la mise en valeur des tourbières; elle a fort bien réussi. A Munich, on étudie surtout l'arge, le houblon et les fermentations.

La station agronomique de Mockern, près Leipzig, est une des plus en vue et la plus ancienne (1851). Après avoir été longtemps dirigée par le célèbre professeur Kuhn, elle a maintenant pour chef le professeur Kellner. Sa spécialité est d'étudier l'alimentation du bétail.

L'instrument fondamental de ses recherches est sa **stalle respiratoire** pour les animaux. Ce curieux appareil dont il existe, je crois, dans le monde que trois autres exemplaires, l'un à Goettingue, le second en Suède, le troisième depuis peu, aux Etats-Unis, se compose d'une chambre hermétiquement close. L'animal, généralement de l'espèce bovine, y est introduit et attaché; devant lui, est une trappe à fermeture étanche par où on lui fait passer ses aliments; sous lui et derrière lui, une disposition savante permet de recueillir toutes ses excrétions solides et liquides. Un ventilateur soufflant lui envoie de l'air pur, et un tuyau emporte l'air vicié à un gros compteur qui en mesure exactement le volume. D'autres petits compteurs peuvent prélever sur le tuyau des parties aliquotes de cet air dans lequel on analyse chimiquement tous les gaz que la respiration et la perspiration cutanée ont produits. Les aliments et les excrétions étant pesées et analysés, on peut faire une balance exacte de ce qui entre dans la machine animale et de ce qui sort.

Tel j'avais vu cet appareil en 1886, tel je le retrouve en 1909: il na guère chômé depuis trente ans. C'est lui seul qui a servi à déterminer la valeur nutritive respectivement de toutes les denrées pouvant servir de fourrages; c'est grâce à lui qu'ont été dressées les tables qui sont l'évangile des éleveurs instruits du monde entier.

M. le professeur Kellner vient d'y terminer les recherches qui n'ont pas duré moins de onze années: recherches dont les résultats ont une importance capitale et dont l'exposé donne la mesure des travaux inouis devant lesquels ne reculent pas les savants allemands.

Les découvertes antérieures avaient démontré que les aliments ne valent que par trois éléments: la **protine**, la **matière grasse** et les **féculents** (sucre ou amidon) qu'ils contiennent; mais un point restait indémontré, quoique capital: les matières grasses sont-elles nécessaires à l'engraissement de l'animal? Les féculents peuvent-ils arriver au même but? Car on sait que, de même que chez l'homme après quarante ans, toute augmentation de poids d'un animal adulte ne proient que d'une augmentation de graisse.

Cette question divisait encore, il y a trois ans, le monde agronomique savant. C'est à la résoudre, à l'aide de la stalle respiratoire, que le professeur Kellner a consacré onze années. Il est parvenu à démontrer irréfutablement que les féculents des fourrages engendrent de la graisse chez les animaux et à déterminer exactement quelle quantité de graisse ils produisent; puis il a recherché si, dans toutes les substances susceptibles de constituer un aliment, ces trois éléments, protéine, graisse, fécule, possédaient identiquement le même pouvoir digestif et nutritif; il a trouvé des différences, les a calculées, en a découvert les causes qui sont le travail de la mastication, le travail automatique de la digestion et diverses fermentations secondaires; enfin, il a fixé les lois d'après lesquelles l'alimentation doit varier avec la taille et la corpulence des animaux.

Les procédés mis en oeuvre par Kellner sont admirables de précision, et rappellent la méthode expérimentale du plus génial de nos savants français, Claude Bernard. Mais, quand on a pu suivre avec lui l'exposé de ces recherches, analyses, pesées, corrections, calculs thermodynamiques, on reste confondu devant l'étendu de ce travail, et on comprend qu'il lui ait fallu, pendant de longues années, sept chimistes assistants uniquement occupés à ces expériences.

Le résultat a été non pas le renversement des tables anciennes, mais une modification profonde dans leurs applications. Kellner en a dressé de nouvelles qui firent immédiatement loi en Allemagne ou tous les agriculteurs ont les yeux tournés vers les stations agronomiques pour en appliquer les découvertes pratiques.

Les constatations de Kellner ont une portée économique qui échappera au lecteur étranger à ces questions. Cependant, tout le monde peut comprendre que l'application généralisée d'une découverte agronomique, vu l'étendue de son champ d'action, peut entraîner des mouvements de centaines de millions.

D'ailleurs, l'importance des travaux du savant professeur de Mockern n'a pas échappé aux nations où l'agriculture marche avec le progrès. Le volumineux ouvrage où il les a consignés, a été traduit en neuf langues, notamment en japonais. M. Grandeau, l'éminent directeur général des stations agronomiques françaises, qui en a publié un compte rendu sommaire le termine par cette phrase: "A la suite des expériences du professeur Kellner, on peut considérer la question de la ration d'entretien des ruminants comme définitivement résolue."

Avec quels subsides les stations agronomiques allemandes peuvent-elles se livrer à des travaux d'une telle envergure? Ils sont de plusieurs sortes: subsides de l'Etat, Mockern reçoit plus de 60,000 francs par an du gouvernement royal saxon; frais des analyses des engrais et des fourrages; ils dépassent 40,000 francs par an; enfin, des dons particuliers et des legs.

VICTOR CAMBON.

La Mission des Agronomes en face des problèmes agricoles

Par le Dr James W. Robertson, d'Ottawa.

Je me réjouis de la formation de cette Société. Elle a sa place et sa sphère d'action toute marquées. Plusieurs d'entre vous se sont déjà connus, et quand ma pensée se reporte sur eux, c'est l'image d'hommes doués des dons les plus brillants, développés encore par un long entrainement et l'expérience dans l'administration, l'enseignement ou d'autres branches de l'activité humaine, qui se présente alors à mon esprit.

SUJETS.— PROBLEMES ET PERSONNES. — Quand j'évoque mes souvenirs, je revois encore les cinq premiers élèves gradués qui sont sortis du Collège d'agriculture d'Ontario. Ils y étaient élèves alors que j'étais professeur. Il m'est arrivé, la semaine dernière, de jeter un coup d'œil sur les sujets d'examens proposés aux candidats de la dernière promotion, et cette lecture me laissa convaincu que la plupart de ces questions m'étaient totalement inconnues. J'ai toujours été impressionné, parfois même jusqu'à l'oppression, en constatant qu'un grand nombre de questions du jour ne m'étaient encore que trop peu connues. Et cependant, au cours de ma vie,

j'ai eu occasion d'étudier bien des problèmes et de leur chercher une solution. Depuis plus de trente ans, conscient de mon incapacité, mon souci le plus pénible a été de découvrir d'abord, de persuader ensuite de se mettre à l'œuvre, des associés qui réunissaient en leur personne la science et la puissance d'action. Et en entrevoyant un avenir qui s'annonce si plein de promesses, je me console en me disant que je n'ai pas trop mal rempli cette partie de ma tâche. Et j'espère encore rendre quelque service, ne serait-ce qu'en aidant à découvrir des hommes de talent et à les placer dans des positions où ils pourront résoudre efficacement le problème agricole.

Je viens de prononcer le mot de problème, et je veux le signaler un instant à votre attention. C'est une expression très courante aujourd'hui: nous avons le problème de la taxe imposée sur les objets de luxe, le problème de la supériorité du mets d'avoine (oatmeal) sur celui de blé-d'Inde grillé (corn-flake). Toute question difficile à résoudre est classée parmi les problèmes, et si j'ouvre le dictionnaire pour trouver la définition exacte de ce mot, je lis "qu'un problème est toute question discutée dont on cherche la solution". Je vous demanderais de donner comme objectif à votre activité la solution d'un problème agricole, solution qui sera basée sur les conditions actuelles de nos fermes canadiennes. Je fais des vœux que ce soit la tâche et l'honneur des agronomes de contribuer à cette solution.

Le seul problème que je désire vous signaler ici, c'est celui des avantages qu'un fermier ordinaire pourrait retirer de vos services. Il se peut que cet homme n'ait aucune confiance dans les collèges d'agriculture et dans les gradués qui en sortent. Vous me dites qu'il a tort. Mais cela n'empêche nullement qu'il peut fort bien croire que les collèges d'agriculture ne peuvent être d'aucun secours pratique pour les travaux pratiques que le fermier exécute sur sa terre. Il se peut même qu'il n'ait aucune idée de la manière dont le gouvernement dirige les Fermes Expérimentales. S'il en est là, je crois qu'il a tort. Mais un fait bien positif et qu'il ne faut pas perdre de vue, c'est que son opinion peut différer de la vôtre et de la mienne. En quoi serez-vous utile à cet homme, le type du fermier ordinaire, voilà le problème agricole tel qu'il se pose chez nous. L'agriculteur technologiste devrait être à même d'aider ce cultivateur à résoudre avec succès les difficultés qu'il rencontre sur sa ferme, mais sans oublier que l'idée arrêtée de plusieurs cultivateurs est qu'un homme qui sort du collège n'est nullement outillé pour les aider pratiquement dans leurs travaux de culture. Ils supposent que vivant dans la théorie, il est demeuré absolument étranger à leur genre de travail, la culture du sol, et qu'il se présentera à eux un beau jour avec des phrases ronflantes et des suggestions utopistes.

Supériorité née de l'éducation. — Mais quelle compétence invoquera l'agronome pour venir au secours du cultivateur ordinaire, le forcer en quelque sorte à accepter son aide, voire même à la lui faire désirer anxieusement? L'éducation qu'il a reçue a dû lui donner cette compétence; sinon, son devoir est de compléter son instruction de la façon la plus consciencieuse. Nombreux sont les facteurs qui concourent dans l'éducation à faire une homme complet. Puis-je vous signaler quelques-unes de ces qualités qu'un homme est supposé avoir acquises au cours de son éducation? Mon expérience des hommes me permet d'affirmer qu'ils n'ont pas toujours retiré de leur éducation tous les avantages qu'elle aurait dû leur procurer. Au cours de ses études collégiales, un homme peut se perfectionner à un double point de vue: intellectuel et social. Vous conviendrez aisément avec moi que les matières inscrites au programme des études, le travail de la classe ou du laboratoire, ne constituent pas exclusivement l'éducation du jeune homme. S'il m'était permis de vous exposer brièvement mes impressions actuelles sur le résultat qu'on devrait retirer des meilleurs systèmes d'éducation, je dirais que ces systèmes devraient tendre à développer les qualités dont l'homme aura besoin toute sa vie, et que je résume dans ce mot: l'idéal, un idéal de la vie qu'il a embrassée. L'idéal du savant sera d'acquérir la promptitude de la pensée par l'étude et le développement constant de son intelligence; l'idéal de l'ouvrier sera de mettre dans l'exécution de ses

travaux une adresse acquise par des actes répétés faits avec ordre; l'idéal d'un administrateur sera l'habileté dans les affaires acquise par l'exercice du jugement. Mais tout en développant les facultés intellectuelles, les systèmes d'éducation ne doivent pas négliger les *sens spirituels.* J'entends par là ces qualités qui rendent les hommes et les femmes capables de tirer toujours le meilleur parti des diverses situations favorables ou défavorables de la vie journalière: 1o l'exacte appréciation des choses, née de l'habitude de raisonner ses actes; 2o le dévouement au prochain, né du sentiment de la responsabilité; 3o l'honnêteté de vie, née de l'habitude d'obéir promptement à la voix de sa conscience et de réfréner ses passions. De l'ensemble de ces actes, que pour mieux développer ma pensée j'ai dû signaler séparément, mais qui en réalité sont unis dans le développement du caractère d'un homme, naît en nous la conviction que nous devons assigner à notre vie un but supérieur et bien défini, un *idéal,* qui en fait toute la noblesse.

L'AGRICULTURE ET LA VISITE DES FERMES. — Je ne ferai qu'effleurer ce sujet dont le but est de venir en aide au fermier ordinaire. Que sera l'agriculture entendue dans ce sens? Un art comme tout autre art, une affaire conduite dans le but de réaliser des profits, une profession qui traite de l'application des principes dans l'art de la culture du sol. Et plus que tout cela: l'agriculture est un état de vie. Alors qu'un magasin ou une usine ne sont que des places où l'homme travaille, une ferme est un lieu où un homme et sa famille vivent. L'agriculture n'est donc pas simplement une occupation, mais un état de vie, et à ce titre, elle constitue pour tous une grosse question d'intérêt national. Il résulte de ces avancés que le problème de l'aide à apporter au fermier ordinaire acquiert une importance capitale. Mais comment saurez-vous ce que ce fermier lui-même pense de ce problème, si ce n'est par les visites que vous irez lui faire chez lui, et par les questions que vous lui poserez alorsé C'est là un des buts de la visite des fermes. Par elle, vous acquérez la connaissance exacte des faits qui, en éclairant vos conclusions pratiques, inspireront vos démarches, et vous aideront à vous tracer votre programme et à formuler vos plans. Ce fut la marche suivie par le Comité des Terres formé par la Commission de la Conservation. En ma qualité de président de ce Comité depuis sa formation, c'est en parfaite connaissance de cause que je puis vous parler de son mode de fonctionnement.

COMITE DES TERRES. — Par son Comité des Terres, la Commission de la Conservation commença ses travaux par des relevés aussi exacts que possible de la nature des terres en culture et de l'influence des systèmes et des méthodes de culture sur le maintien de la fertilité et du rendement du sol. Pendant plusieurs années, ce Comité a dirigé des enquêtes sur la condition de groupes de fermes réparties dans plusieurs régions spécifiquement distinctes dans toutes les provinces. La visite comprenait 62 groupes comprenant un total de 2,245 fermes. Le résultat de cette enquête se trouve consigné dans le Rapport annuel. On y constate que la fertilité du sol va sans cesse en diminuant, que le champ des mauvaises herbes s'élargit d'année en année, et que les rotations régulières sont peu pratiquées.

Cependant, dans chaque groupe visité, quelques fermes se faisaient remarquer par leur parfait état d'entretien et constituaient de vrais modèles de culture profitable. Aussi, les cultivateurs des groupes de fermes visitées en 1912 et 1913, de concert avec la Commission de la Conservation firent choix d'une de ces fermes destinée à servir pour chaque groupe de ferme de démonstration.

FERMES DE DEMONSTRATION. — La Commission ne prétendait nullement prendre sous son contrôle la ferme de démonstration. Son propriétaire ne recevait ni salaire ni subside spécial. Il consentait cependant à recevoir régulièrement les visites de l'agronome délégué par la Commission et à mettre en pratique sur sa ferme les conseils ou suggestions qu'il trouverait profitables pour lui. Par l'octroi d'un léger secours, la Commission encouragea l'emploi de graines de semences de première qualité, l'ensemencement d'une plus grande étendue de trèfle et de mil, et l'adoption d'une méthode plus efficace pour enrayer les mauvaises herbes. Le but de ce travail de la Commission, combiné avec celui des propriétaires des fermes de démonstration, était de découvrir si les conseils de l'expert délégué par la Commission, appliqués aux méthodes modernes des cultivateurs pratiques, auraint pour résultat le maintien de la fertilité du sol, l'accroissement des profits et du bien-être pour le cultivateur et sa famille. On tient des réunions sur ces fermes dans le but d'expliquer aux fermiers du voisinage les méthodes employées et de leur démontrer les résultats qu'elles permettaient d'obtenir quand elles étaient bien appliquées, non plus sur une ferme du gouvernement, mais sur une ferme qui se trouvait dans les mêmes conditions que les leurs. Les résultats furent frappants, les améliorations notables et nombreuses. Plusieurs autres localités réclamèrent aussi des fermes de démonstration. Mais la Commission n'étant pas une branche du Service Fédéral, et ayant par ailleurs atteint son but en indiquant un moyen efficace pour promouvoir le maintien de la fertilité et l'accroissement des profits, elle offrit au gouvernement le contrôle de ces fermes. C'est ainsi qu'il existe aujourd'hui un service spécial des Fermes de démonstration au département des Fermes Expérimentales.

COMTE DE DEMONSTRATION. — Le succès remporté par cette enquête suivie de l'établissement de fermes de démonstration, engagea la Commission à entreprendre une seconde enquête dans quatre comtés, dans le but d'en choisir un comme comté de démonstration. Le travail commencé dans le comté de Dundas, dans l'Ontario, doit se continuer encore deux ans pour atteindre la limite des cinq ans fixée pour cette enquête.

J'ai confiance qu'à la suite de ce commencement de recherches expérimentales, au moyen de fermes et de comtés de démonstration, chaque comté ou chaque municipalité comptera avant longtemps sa ferme de démonstration. De plus, le progrès réel accompli dans le comté de démonstration de Dundas fera une telle impression que les principes fondamentaux de cette enquête seront acceptés et mis en pratique.

Le point important est de trouver, de développer et de mettre en œuvre l'habileté et le caractère des hommes et des femmes les plus intelligents de chaque groupe, pour en faire des chefs, et de faire bénéficier

chaque groupe des progrès réalisés par d'autres groupes mieux favorisés. Par là, j'entends la bonne culture, les bonnes écoles, les bonnes routes, la santé et les bonnes relations sociales. Je dis *bon*, mais sur les fermes et les comtés de démonstration, nous visons au *meilleur*, de façon à ce que les conditions du groupe lui-même, pris dans l'ensemble, soient au moins *bonnes*.

NECESSITE DE PLUS D'ORGANISATION. — Pour porter à leur maximum le maintien et l'amélioration de la fertilité de ses terres, le rendement de ses récoltes et de ses troupeaux, le Canada se voit encore imparfaitement et incomplètement organisé. Je ne vise pas par là l'organisation des services du ministère de l'agriculture fédéral ou provincial, mais le manque de moyens organisés pour amener les cultivateurs ordinaires à mettre leurs fermes sur un pied aussi profitable que celles des meilleurs fermiers. Le plus grand obstacle est que les connaissances techniques dont profitent actuellement les meilleurs fermiers ne sont pas encore répandues parmi la classe moyenne des cultivateurs. Cependant il ne faut pas perdre de vue que c'est de la manière dont notre population rurale canadienne, intelligente, active et laborieuse, administre les fermes ordinaires que dépendent la prospérité, la stabilité et le progrès du pays.

Si l'agriculture est un genre de vie adoptés par quelques individus pour gagner leur pain quotidien, elle mérite aussi d'être considérée comme une question d'intérêt national, et à ce titre, elle réclame des perfectionnements qu'on pourrait et qu'on devrait lui donner. C'est sur l'amélioration constante de notre agriculture, ainsi que de nos autres ressources naturelles, que nous devons compter principalement pour maintenir notre prospérité, tracer notre voie en tant que nation et payer notre dette publique. Bien plus, dans la concurrence toujours plus vive que nous sommes assurés de rencontrer sur les marchés du monde, c'est une illusion de songer à conserver notre situation actuelles si nos populations ne sont pas aussi instruites, aussi entraînées et aussi bien organisées que celles des autres pays.

Une organisation s'impose donc pour aider le fermier ordinaire à conserver la fertilité et le rendement de sa terre, et j'ose vous soumettre les cinq propositions suivantes:

1. Confier à des hommes et à des femmes hautement qualifiés des travaux de recherche dans les champs d'expérimentation et les laboratoires, ainsi que des enquêtes sur les conditions actuelles du marché dans les divers pays.
2. Poursuivre le travail d'expérimentation accompli actuellement sur les Fermes expérimentales, coordonner les résultats déjà acquis et les appliquer aux opérations pratiques de la culture, afin d'obtenir les meilleurs résultats économiques dans des conditions si variées de climat, de sol, de marché, de main-d'œuvre, etc.
3. Au moyen de comités formés de rédacteurs compétents, étudier, interpréter et publier, en termes simples et concis, les conclusions auxquelles ont abouti des recherches consciencieuses et exactes, en en faisant ressortir le côté pratique et les avantages économiques sous notre climat canadien. Ces comités pourraient étudier tout d'abord les questions générales suivantes:
   a) La relation qui existe entre la texture physique et la constitution chimique des sols et le rendement des récoltes.
   b) Les systèmes et les méthodes de production des plantes de grande culture comparés avec les profits et le maintien de la fertilité du sol.
   c) L'élevage, l'alimentation et l'entretien des animaux de la ferme et l'écoulement de ces produits.
   d) La culture et la vente des fruits et des légumes.
   e) La lutte contre les maladies des plantes et les insectes qui leur sont nuisibles.
4. Amener les cultivateurs, dans chaque municipalité importante, à choisir une ferme de démonstration sur laquelle ils pourront constater par eux-mêmes les résultats obtenus par l'application combinée des conseils scientifiques d'un agronome et des méthodes de culture d'un fermier qui fait déjà de son entreprise une affaire vraiment rémunératrice.
5. Former parmi les agriculteurs une association ou une "Société de meilleure Culture", qui se tiendrait en relation étroite avec chaque ferme de démonstration et fournirait aux chefs naturels d'une localité l'occasion de donner leur pleine mesure, par l'élan progressif qu'ils imprimeraient à chaque ferme et par là même à toute la municipalité.

RESULTATS PROBABLES. — L'exécution de ce plan, qui permettrait de mettre à la portée des cultivateurs ordinaires les découvertes et les renseignements des meilleures institutions et des meilleurs esprits, entraînerait pour eux d'immenses résultats pour une dépense relativement minime. Son application offrirait aussi un merveilleux champ d'action pour les esprits les mieux doués, les mains les plus habiles et les cœurs les plus généreux que possède le Canada.

Quand son fonctionnement sera parfait, on peut raisonnablement en attendre une augmentation d'au moins 20 pour cent de la valeur actuelle des terres. Et cet estimé n'est pas une pure hypothèse, mais il est basé sur les résultats déjà obtenus dans les localités avoisinnant les fermes de démonstration. Au taux actuels des prix, ces 20 pour cent d'augmentation représenteraient un total de 300 à 350 millions, suivant les conditions de température plus ou moins favorables, tout en conservant et en améliorant la fertilité de nos terres.

A titre d'Agriculteurs Technologistes, vous pouvez aider grandement à la préparation et au perfectionnement d'une semblable organisation, et contribuer ainsi à la solution du problème le plus épineux et le plus important de notre agriculture: l'amélioration constante des fermes ordinaires, et par là même de toute la population rurale du Canada.

Je dirai même plus. En tant que Société, vous pouvez accomplir des choses dont la gloire rejaillira sur votre race, la famille à laquelle vous appartenez et l'institution qui vous a formés. Et plus vous ferez, et le mieux ce sera, pour le Canada d'abord et pour le monde entier.

VOLUME I. MARCH, 1921. NUMBER 3

Scientific Agriculture

J. B. REYNOLDS, M.A.
President of the Ontario Agricultural College.

La Revue Agronomique Canadienne

Scientific Agriculture

Official Organ of the Canadian Society of Technical Agriculturists

A Magazine devoted to the general advancement of Agriculture in Canada.

Published in the interests of Agricultural Science and Research.

Vol. I. Gardenvale, P. Q., March, 1921. No. 3.

CONTENTS

Published Monthly by the Industrial and Educational Publishing Company, Limited, Garden City Press, Ste. Anne de Bellevue, P. Q. 'Phone 165.

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Editor and General Secretary—FRED. H. GRINDLEY.

Subscription to any address in Canada, the United States, or the British Empire, $2.00 yearly; other countries, postage extra.

Changes of advertisements should be in the Publishers' hands ten days before the date of issue.

La Revue Agronomique Canadienne

PAGES 137-144

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Secretary-Treasurer—W. W. Thomson, 2856 Retallack St., Regina.

Northern Saskatchewan Local Branch Executive:

President—W. P. Thompson, University of Saskatchewan, Saskatoon.

Vice-President—W. A. Munro, Experimental Farm, Rosthern.

Secretary-Treasurer—K. W. Gordon, University of Saskatchewan, Saskatoon.

Committee—W. J. Rutherford, University of Sask., Saskatoon.

J. T. Bridge, Prongue.

J. M. Varey, S. S. B., Saskatoon.

Southern Saskatchewan Local Branch Executive:

President—J. G. Robertson, Live Stock Commissioner, Regina

Vice-President—A. M. Walker, S. S. B., Regina.

Secretary-Treasurer—W. W. Thomson, 2856 Retallack St., Regina.

Committee—E. C. Myers, Grand Coulee.

N. McKenzie, Experimental Farm, Indian Head.

General Secretary-Treasurer,—FRED. H. GRINDLEY, Gardenvale, P. Q.

:-: EDITORIAL :-:

IN PRAISE OF THE O. A. C.

For over forty years, from a small beginning, with a steadily expanding purpose and a rapidly strengthening influence, the Ontario Agricultural College has done its duty. It has turned out graduates who, as a result of their training, have carried new principles and practices into rural communities, have given freely of their knowledge to any who sought it and have, in a score of different callings and in every province of Canada, reflected credit upon their Alma Mater. Nor do we mean to imply that these men have not gone further afield. The gain of other countries and especially the United States, has been in this respect the loss of Canada; for, to quote one of the speakers at the recent convention in Toronto, "From the Atlantic to the Pacific, from the Gulf of Mexico to the farthest north, who sees the letters O. A. C. sees Ontario Agricultural College."

Thus, by more than geometric ratio, has the individual student leaving Guelph, spread the fame of the college. But that is incidental. The important point is that he, too, has done his duty by advancing agriculture, and who can blame the man in any calling who, in doing his duty, is generous enough to give credit to the institution in which he was trained? Taking into consideration the age of the Ontario Agricultural College, the number of students who have passed through its doors and the widely scattered constituencies in which they are now working, we can imagine a picture, with the college as its background, that could not easily be overcharged. And the title of the picture might well be "Duty Well Done".

We do not pretend that the Ontario Agricultural Collegs is beyond criticism, for no progressive enterprise can escape criticism. In the main, criticism is constructive and usually a sign of advancement. The scope and future development of all agricultural colleges must be moulded, in a large degree, out of merited suggestion and criticism, and upon the extent to which these institutions are willing to respond to comment, will their rate of progress and measure of usefulness depend.

And so, in doing our monthly editorial duty, we send an issue to the presses which gives deserving prominence to the O. A. C. We wish long and continuous prosperity to an institution already long established and we wish success to the provincial Alumni, now organized, and to its members. Presumably our editorial duty is to record thoughts that are dominant and subjects that are timely. Therefore editorials, though appearing, in this instance at least, on the first page, are usually written last. They are always written with good intentions, even if in great haste. No thought could be more dominant, few subjects more timely and no duty more pleasant than a word of praise to a deserving institution.

AGRICULTURAL POLICIES.

In an era when agriculture is so manifestly the main source of Canada's prosperity, no question is more important than the policies which direct that industry. Policy, we may suppose, should be interpreted to mean the manner in which the several branches of agriculture are directed, the definite duties assigned to each and the extent to which those duties are co-related to bring about efficiency and to avoid duplication of effort.

Within very recent years the various agencies which direct the agricultural policies of Canada appear to have realized the importance of a co-ordination of effort. The meeting of the provincial deputy ministers of agriculture with representatives of the Dominion Department of Agriculture, which was held in Ottawa just one year ago, appeared to be a step in the right direction. The report of that meeting has now been published and we hope that progress is being made in respect to some of the more important decisions reached. Inasmuch as the question of agricultural policies, besides affecting the Dominion and Provincial Departments of Agriculture, also bears directly upon agricultural colleges and covers such vital questions as research, experimentation, extension, education, administration, publicity, etc., it would seem that a great deal of very careful thought will have to be given before uniformity of policy can be expected. The situation as it exists today is not by any means entirely satisfactory and it would appear that before needed adjustments can be made, institutions and departments must come together, face the conditions in a broadminded, unselfish and co-operative light and agree upon a definitely stated and clearly co-ordinated arrangement.

At a recent meeting of the B. C. Branch of the Canadian Society of Technical Agriculturists, held in Vancouver, the members passed a resolution endorsing the agricultural policies on co-relation of work, as laid down by President Klinck in Ottawa last June. It is further suggested in the resolution, (1) that the recommendations of President Klinck be presented at the Winnipeg Convention of the C. S. T. A. next June, as a basis of discussion, (2) that if approved, the Federal Minister of Agriculture be requested to appoint a commission to enquire into the question of division and co-relation of work, and (3) that the report of the commission be submitted to and reported on, by a general meeting of the C. S. T. A. before any of its recommendations are carried into effect.

There is much to be said in favor of the resolution outlined above. A fair representation in Winnipeg of responsible officials should mean the beginning of definite steps towards much needed adjustment in a matter of great national importance.

A BUREAU OF INFORMATION.

There is not at the present time in Canada any source from which information can be obtained regarding the qualifications, present duties and special interests of trained agriculturists. It has been suggested that the Canadian Society of Technical Agriculturists, having in its membership over 500 trained men, 97 percent of whom are University graduates and all of whom have had special training, might function as a very desirable bureau from which information could be obtained by institutions employing technically trained men.

While the principle is commendable it would depend, for its most efficient operation, upon the full support, not only of departments, colleges, and commercial firms, but also of the individual members themselves. It would be necessary for some central office to collect complete information regarding each member of the Canadian Society of Technical Agriculturists. It would be equally necessary that when vacancies occur requiring specially trained applicants, notification should be sent to the established bureau. And, in the third place, members of the society who were desirous of taking up new work should refer their wishes to this bureau.

While the whole question is under consideration, it will be necessary to give considerable time not only to the proper consideration of details but also to the collection of information from the members, before the bureau can be definitely established. In the meantime opinions and comments will be solicited from officials who are in a position to decide the merits of such a movement. It should be understood that the bureau is intended to assist employers of technical men as much as it intends to assist the men themselves. In other words, it is not a union movement emanating from unsatisfied employees but a movement suggested by those who feel the need of some central office from which they could obtain information that would be beneficial to them in the selection of men to carry out definitely assigned duties.

The members of the Dominion Executive Committee of the Canadian Society of Technical Agriculturists have already been consulted in the matter and have expressed themselves as being favorable to the establishment of such a bureau. It now remains for the Dominion Executive to collect the necessary information from the members and to secure the co-operation of all these who employ technically trained agriculturists. The task is difficult but possible and should ultimately serve a useful purpose.

As the General Secretary of the C. S. T. A. is giving special consideration to the preliminary details, it would be very helpful if a free expression of opinion could be given to him by any member who is interested.

THE OBJECTS OF THE C.S.T.A.

If the Canadian Society of Technical Agriculturists is to attract all of those in this country who are eligible for membership and if it is to retain and sustain the active interest of those who have already joined, there will have to be a clear understanding on the part of members and eligible members of the objects for which the organization stands. To those who have given the Society direct assistance in the work already accomplished and who have in this way been more closely associated with the Society than others, the principles of the organization are perhaps more clearly understood than by those whose connection has not been as direct or as intimate. An understanding of the objects for which any society stands is imperative, but such an understanding cannot always be formed as the result of the personal connection of each member with the progress of the parent body and so it remains for those more closely connected with the direction of policy and progress, to give to the mass of members the clear understanding that is so desirable.

In the present issue President Klinck, the first president of the Canadian Society of Technical Agriculturists, has given a very clear statement in which he outlines the main objectives which this new organization hopes to fulfil. The statements of President Klinck may be accepted as being given after, and as the result of, sound judgment. They should remove any doubts or misgivings as to the need for this new organization and they should encourage a large number of those whose names are not now on the list of members, to send in their applications and become directly associated with the progress of an organization whose objects are so strongly upheld by President Klinck.

RURAL ENGINEERING.

The important place which a knowledge of mechanics holds in the pursuit of agriculture is apparently becoming more fully realized by those responsible for the advancement of the industry. One by one the agricultural colleges are adding a distinct place in their curriculum to agricultural engineering and we find that manufacturers are responding rapidly to the demand created for new and necessary appliances in the equipment of the farm home and in the machinery for the successful operation of the farm itself. There is nothing which will tend to relieve farming from the "sordidness and isolation" referred to by Pres. Reynolds in Toronto two weeks ago, so much as the addition to the farm of any equipment that will lessen physical energy by promoting mechanical energy.

In the columns of "Scientific Agriculture," the importance of rural engineering will not be overlooked. We have, in the present issue, published an article by J. M. Smith of the University of Alberta in which the place of engineering in agriculture is clearly summed up. This article is intended to serve as an introduction to a series of articles dealing more specifically with the whole question of engineering as applied to farm life.

History and Development of the Ontario Agricultural College

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Professor of Field Husbandry and Director of Field Experiments, Guelph, Ont.

Sir John Carling, Ontario's first Commissioner of Agriculture, in his report for 1870, definitely proposed the establishment of two schools, one for Agriculture and the other for Mechanic Arts. The outcome of this recommendation was the foundation of the School of Practical Science in Toronto and the purchase of five hundred and fifty acres of land for a School of Agriculture at Guelph. The farm at Guelph was purchased and came into the possession of the Province in December, 1873. The name decided upon for the institution was the Ontario School of Agriculture and Experimental Farm.

On the 29th of July, 1873, Mr. Henry McCandless, from Cornell University, was appointed the first Principal. On the first day of May, 1874, the school was opened. Owing to the resignation of Principal McCandless on the 18th of July of the same year, however, the work was taken over temporarily by Mr. Wm. Johnston, B.A., of Toronto, who had previously been appointed rector. In April, 1875, Mr Chas. Roberts, of Surrey, England, a prominent graduate of Cirencester Agricultural College, was appointed as Principal, but owing to sudden illness resigned after one day's active service. Wm. Johnston was then appointed as permanent Principal, which position he held until the end of September, 1879. Principal Johnston, although somewhat handicapped by his lack of practical experience, proved to be an excellent organizer, an efficient executive and a prolific writer. He classified the work in the different departments and did much to give character and stability to the school. At the close of his five years' term of office he wrote as follows: "I have resigned at the commencement of what might properly be termed the beginning of the institution at the close of the preparatory stage. My work has been to assist in laying the foundation—others must rear the superstructure."

In the autumn of 1879, the name of the institution was changed from the Ontario School of Agriculture and Experimental Farm to the Ontario Agricultural College and Experimental Farm. Dr. James Mills was appointed President of the College, taking office on the first of October, 1879, which position he retained until twenty-five years later. Dr. Mills graduated as a Medallist at Victoria College, Cobourg, Ontario, after which he filled the position of Principal of Brantford Collegiate Institute with marked distinction. During the two and one-half decades in which Dr. Mills was President of the College the institution made substantial and permanent progress. While it is true that in the earlier stages of the President's regime the institution was used largely as a political football, nevertheless, through his wise leadership, perseverance, devotion to duty and exactness and capacity for detail, the College later received the enthusiastic support and encouragement of all political parties.

On the resignation of President Mills in 1904, Dr. G. C. Creelman was immediately appointed as his successor. President Creelman spent his boyhood days on his father's farm in Simcoe County, Ontario, and was later a member of the first graduating class of the Ontario Agricultural College in 1888. After securing his B.S.A. degree he spent nine years as Professor of Biology at the Agricultural College of Mississippi, and just previous to his appointment here was superintendent of Farmers' Institutes for Ontario. The President, therefore, brought with him to this institution practical experience, scientific knowledge, teaching ability and administrative qualifications which proved of great service to him in his official capacity.

Dr. Creelman was a comparatively young man, enthusiastic, energetic, hospitable and a fluent and popular public speaker. During his sixteen years' Presidency, the farm was enlarged, the College courses extended, the number of students greatly increased, and student government established in the College.

C. A. Zavitz, B.S.A., D.Sc., Professor of Field Husbandry, O.A.C.

With the resignation of Dr. Creelman in 1920, President J. B. Reynolds was appointed and as-

sumed his official duties early in July of the same year. As was the case with both Dr. Mills and Dr. Creelman, President Reynolds spent his early days on an Ontario farm. He graduated from Toronto University as a Medallist, after which he taught school for a time and then joined the Staff of the Ontario Agricultural College in 1893, where he remained for twenty-two years, first as Assistant Resident Master, later as Professor of Physics and Lecturer in English, and still later as Professor in English. In 1915 he was appointed President of the Manitoba Agricultural College, where he discharged his duties until he was recalled to Guelph to take the Presidency of the Ontario Agricultural College.

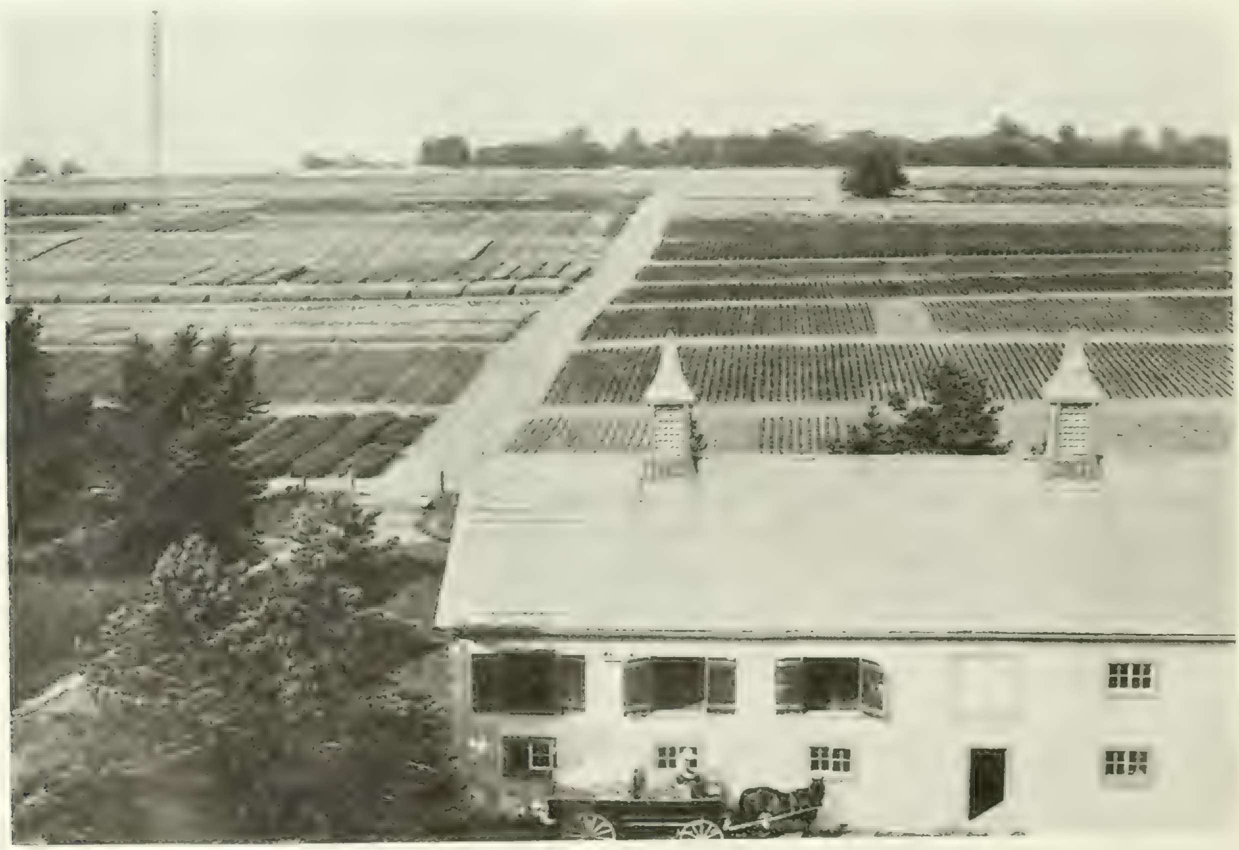
President Reynolds brings with him high scholarship, excellent experience, strong convictions, and the capability of expressing himself clearly and forcibly on the public platform. It is anticipated that under the careful administration of our new President the institution will continue to make steady and substantial advancement.

While it is important to have wise leadership, it is equally essential to have a teaching staff whose members possess, not only the required efficiency and adaptabiliy for performing their various duties satisfactorily, but also the esteem of everyone through their high ideals of character so essential in the successful development of an educational institution.

No matter how efficient the faculty of an Agricultural College, the best work cannot be accomplished without suitable land, buildings and all essential equipment throughout the entire institution. The land at the Ontario Agricultural College has been increased from 550 to 717 acres and has proven to be very well adapted to its various requirements. With the process of advancement, the resident accommodation has been increased from a remodelled farm dwelling capable of housing thirty students in 1874 to two large residences accommodating nearly four hundred boys. In addition to this, the Macdonald Hall, which is also a part of the College proper, makes a delightful residence for one hundred and twenty girls. Besides these three residences there are nineteen other large, well equipped buildings in use for the various needs of the institution. Plans are now in progress for the erection of at least three more in the immediate future, viz., the Memorial Hall, one for the Dairy Department and one in connection with Veterinary Science.

All buildings have been erected by the Ontario Government with the exception of the Massey Hall, which was donated by the Massey Estate, and the Macdonald Hall and Macdonald Institute by the late Sir William C. Macdonald. Some of the recent buildings have been erected by the Provincial Government by money received from the Federal Grant.

The Agricultural College is a Government institution and in its forty-seven years of existence has come under the control of the Conservative, the Liberal and the Farmer-Labor parties. From 1874 to 1888 it was under the direct control of four Commissioners, in the following order: Hon. Archibald McKellar, Hon. S. C. Wood, Hon. Jas. Young and Hon. A. M. Ross; and from 1888 to the present time, under the jurisdiction of six successive Ministers of Agriculture, viz., Hon. Chas. Drury, Hon. Jno. Dryden, Hon. Nelson Monteith, Hon. Jas. S. Duff,



A view showing part of [illegible] 2,500 experimental plots devoted to Field Husbandry at the O.A.C. The cereal crops grown on the plots are threshed [illegible] barn shown in the picture

Hon. Geo. S. Henry and Hon. Manning W. Doherty.

From 1874 to 1887, the regular College course extended over a period of two years, at which time a diploma was granted to each student who completed the course satisfactorily. In 1887 the College was affiliated with the University of Toronto and an additional year was added to the course. The final examinations were conducted by examiners appointed by the Senate of the University and the successful candidates were granted the degree of B.S.A. at the regular University convocation. In 1901 the College year was reduced from three to two terms, viz., Fall and Winter, and an additional year was added to the course. Thus a diploma was granted at the end of two years and the B.S.A. degree at the conclusion of two additional years. In 1920, two distinct courses were inaugurated, viz., a two-year course for the Associate Diploma and a four-year course for the degree of B.S.A., the latter requiring for entrance qualification an Ontario Junior Mariculation certificate in Arts and Science, or its equivalent. This necessitates the student selecting one or the other of these two courses at the beginning of his College career.

In addition to the regular two and four-year courses, numerous Short courses of two, three, four, six and twelve weeks' duration have been conducted in the practical departments of the College, including the Macdonald Institute.

Approximately 21,600 young men and young women have enrolled at the Ontario Agricultural College since its inception in 1874 to the end of the calendar year, 1920. In the early history of the institution the number of students was comparatively small. It is interesting to note that for the first five years, from 1874 to 1879, the yearly attendance was as follows: 24, 32, 40, 87 and 106, respectively. According to the College records, the total enrollment now shows that about 4600 entered the regular agricultural course, 8800 the Winter short courses, 3100 the Summer short courses, 200 the Manual Training course, and 4900 the long and short courses in Home Economics.

In 1919, a survey was made with the object of securing the present addresses and occupations of the ex-students who entered the Ontario Agricultural College for the regular course in agriculture.

Of the 4491 registrations in the regular agricultural course, 554 were students in attendance, 1574 had received the Associate diploma in agriculture granted by the College at the conclusion of the two years' course, and 698 had received the B.S.A. degree at the end of the complete course of four years.

The addresses of the ex-students showed 85 per cent. located in Canada, 9 per cent. in forty States of the American Union and 6 per cent. in thirty-one other countries. Of the ex-students of the regular course now residing in Canada, 72 per cent. of the total number and 67 per cent. of the B.S.A. men are located in the Province of Ontario. According to the recent information received, 80 per cent., or four-fifths, of all the ex-students of the regular course; 80 per cent. of the Diploma men, and 92 per cent. of the B.S.A. men are engaged in agricultural work.

It is found that if the forty-four years of the College, from 1874 to 1917, inclusive, are divided into four periods of eleven years each, the ex-students of the regular course are engaged at the present time in occupations according to the following percentages:

A section of the Horticultural grounds at the O.A.C., where experimental and plant breeding work is conducted with fruit fruits and vegetables.

Four 11-year periods.	Farmers.	Agriculturists other than Farmers.	Non-Agriculturists.
1874—1884	50	5	45
1885—1895	58	16	26
1896—1906	57	30	13
1907—1917	50	42	8

The percentage on the land is fairly constant, varying not more than 4 per cent. in any one period from the general average of 54 per cent. It is interesting to note that the increase in percentage of those following agricultural work other than farming corresponds closely with the decrease in percentage of those following non-agricultural pursuits.

Five ex-students, who were recently farmers, now fill the important positions of Premier, Minister of Agriculture, Provincial Secretary, Minister of Education and Minister of Public Works of the Ontario Government. Numbered amongst the graduates of the Ontario Agricultural College there are seven Commissioners and Deputy Ministers of Agriculture, eleven Presidents of Universities and Agricultural Colleges, twenty-one Agricultural Journalists, fifty Agricultural Representatives, in addition to a comparatively large number of other graduates who are associated in various ways with the Provincial and and Dominion Governments of Canada.

It is of interest to learn that in a survey made of the Alumni of Yale University in Connecticut it was found that only 2 per cent. of the graduates of that institution were in any way engaged in agricultural work.

The ex-students of the Ontario Agricultural College have already formed three Alumni Associations, one for Eastern, one for Central and one for Western Ontario. As this goes to press, a meeting of the ex-students of the regular course is being planned in order to complete the organization work for a Provincial O.A.C. Alumni Association. It is expected that with the formation of this strong organization an agency will be inaugurated which will be capable of rendering inestimable service to the agriculturists of the Province.

The Institution from the beginning has been in reality an Agricultural Experiment Station as well as a College. From an act outlining the original work of the Ontario Agricultural College, I make the following quotation:

"Experiments with the different varieties of cereals, grasses, and roots; of trees, plants, shrubs, flowers, and fruits; with different modes of cultivation; with different manures; with the breeding, raising, and fattening of animals; with the products of the dairy; and with whatsoever else may be of practical benefit in adding to the knowledge of the facts, principles, and laws of the science and art of agriculture, horticulture, and arboriculture, under the climatic conditions of this Province, shall be carried out on the experimental farm; and the modes of procedure and results published from time to time."

In 1876 Professor Wm. Brown, Superintendent of the Farm, reported as follows:—"Shortly after my appointment here we took up the subject of experiments in all forms—the feeding and breeding of animals as well as the cultivation of crops under a variety of conditions." Experiments and investigations which have been carried on extensively have, therefore, formed a very important part of the work of the Institution throughout its entire history. Our well equipped laboratories, well stocked scientific library, and specially arranged museums have proven serviceable for both College and station workers. Both the field and livestock experiments have not only furnished important information for the farmers of the Province but have also supplied excellent material for illustration purposes for the students of both the short and long courses. The students, therefore, have received much advantage from observation of the experiments and from personal contact with the investigators themselves. Advanced students are frequently employed as assistants in some of the agricultural work. It has been clearly demonstrated that both the Agricultural College and Experiment Station have been mutually helpful to each other.

In 1879 the ex-students, students, and officers of the Ontario Agricultural College formed an organization known as the Ontario Agricultural and Experimental Union, the second article of the constitution reading as follows:—

"The object of this Association shall be to form a bond of union amongst the officers and students, past and present, of the Ontario Agricultural College and Experimental Farm; to promote their intercourse with the view of mutual information; to discuss subjects bearing on the wide field of agriculture, with its allied sciences and arts; to conduct experiments in this field in union as far as possible, or by individual efforts; to secure the co-operation of the agriculturists of the Province in this work, and to meet at least once annually to hear papers and addresses delivered by competent parties, and to report upon the labors of the past year."

The co-operative experimental work has been conducted by committees appointed by the Organization with duties outlined as follows:—

"It shall be the duty of each Experimental Committee to decide upon its own course of experiments for each year; to purchase and distribute the material to be used by experimenters, and to receive and compile the reports, and submit them to the annual meeting."

During the first seven years of this Organization but little was accomplished. In 1886, however, a definite line of co-operative experimental work was started with twelve farmers who undertook the experimental work that year, and from that time the number of experimenters has been steadily and substantially increasing until it reached over five thousand in one single year just previous to the war. In the present year, there are eight distinct committees actively engaged in the co-operative work, including agriculture, agricultural botany, forestry, agricultural chemistry, apiculture, farm literature, agricultural physics, and agricultural bacterioogy. The co-operative, experimental work in agriculture has now been conducted for thirty-five years, during which time there have been 97,296 distinct tests made throughout Ontario. Each of these experiments consisted of from two to ten plots. The following figures show the average yearly number of Ontario farmers actually engaged in the work in each of three periods of from eleven to thirteen years:

Periods	Years	Average Number of Experimenters per Annum
1886—1896	11	720
1897—1907	11	3,386
1908—1920	13	4,017

For the co-operative experimental work in agriculture all the instructions and materials are furnished the experimenters from the College through the medium of the Experimental Union committee in charge of that branch of the work. This branch of agricultural extension work has had a very marked influence in the progressive development of the agriculture of the Province. A number of the leading varieties of farm crops which are now grown very extensively throughout Ontario were originated at the Ontario Agricultural College and were introduced throughout the Province through the medium of the Experimental Union.

A portion of the O.A.C. plant Breeding grounds with farm crops, showing some of the work with clovers, grasses and wheat.

The Farmers' Institutes of Ontario were organized by Dr. Mills in 1885. The entire arrangements for these meetings throughout Ontario were carried out at the Ontario Agricultural College for a period of ten years. After that time the Provincial Institutes were placed under the supervision of a separate head and at a later date the headquarters of the Institutes' Branch were moved to the Agricultural Department, Parliament Buildings, Toronto. After twenty-six years' experience in having the headquarters of this branch of extension work separated from the College, it is now understood that the present Government intends to return to the former policy and again establish the headquarters of the Institute work at the College and make this a part of a complete extension department of the Institution.

Although the Ontario Agricultural College has always prided itself in giving a general as well as a specialized agricultural education, it is gradually becoming more complete and more thorough in this respect and it is expected it will soon reach a greater state of perfection than ever along the lines of teaching, research, and extension work.

Mr. C. D. Jarvis, Specialist in Agricultural Education for the United States, made the following statements in 1920:—"In this country most of the colleges are organized into three distinct divisions: namely, resident teaching, extension teaching, and research. It is the belief that the workers in these respective fields should be associated very closely, and that, to a very limited extent, participation in two or more lines of activity is recommended."

"There is a feeling that there should be in each subject-matter department one or more persons whose interests are predominantly resident teaching; one or more whose interests are predominantly research; and one or more whose interests are predominantly extension teaching."

"Furthermore it is believed that the teaching work is strengthened by limited participation in extension work and in research work. It is believed also that the research men are benefitted by having contact with students, especially graduate students. It has been demonstrated also that the extension workers are able to bring to the attention of the research and teaching specialists the real live problems of the field."

The great importance of the close association of teaching and research work at an agricultural college was emphasized in the following statements made last year by Dr. A. C. True, Director of the States Relations Service, and who is the highest official in agricutural college and experiment station work in the United States:—

"Experience in the United States clearly shows that it is best to have the headquarters of the agricultural experiment stations at the agricultural colleges. A few separate experiment stations have been successfully conducted in the United States, but they have been relatively expensive establishments."

"In Alaska and the insular possessions experiment stations are carried on separately, but this is because so far there are either no agricultural colleges or such institutions are so weak that it has thus far seemed best to continue the separate stations and keep them directly under federal control."

The whole experience of the Ontario Agricultural College seems to emphasize strongly the importance of having a close relationship between the teaching, the research, and the extension departments of the work. This happy combination of these three lines of activity, therefore, has undoubtedly had a marked influence on the graduates who have been sent out from this institution. Not only have they had the opportunities of class-room instruction but also the

A partial view of the Campus and the Experimental Farm at the O.A.C., showing four of the twenty-two main buildings of the Institution

privilege of coming into very close contact with the practical operations of the farm, the scientific investigations of the different departments, the field experiments and plant breeding work in agriculture and in horticulture, and in the various demonstrations in field, stable, garden, greenhouse and museum.

To educate for agriculture, it seems essential to do it through institutions where the ideals and the aspirations are in close sympathy with rural life.

What can Agricultural Engineering do for Agriculture?

J. MACGREGOR SMITH, Professor of Agricultural Engineering, University of Alberta.

At the outset let me quote a statement made by a farmer about to retire from active farm work:

"When we are ready to quit the strenuous period of life, wife and I have planned to fence off a couple of acres along the road and put up a house modern in every respect. We will have our own lighting, water supply and sewage disposal systems, and maybe a mechanical refrigerator. We won't move to town where nobody wants us, but we'll stay right here where our friends and interests are, and where we can help along with the work just as much, but not any more than we care to."

There is much sound common sense to the farmer's statement, but he needed this vision twenty years ago. The time of retiring from farm work is usually determined, not by how long can father stand it, but by how long mother can. Let us point this out most emphatically on every occasion.

Many views are expressed on the standardization of equipment, the tractor versus the horse, and so on. We are wrong in thinking that the planning of a barn and the efficiency of tractors constitute the sum and substance of helpful agricultural engineering work. We may think the ventilation of a barn is more important than getting the smoke of frying meat and potatoes out of a farm kitchen. The important point for those responsible for arranging courses and for giving them, is to remember that the subject covers a wide field and one that is worthy of an important place in every agricultural course. A student who goes back into a community should realize the value of knowledge gained about livestock and field crops, and at the same time be in a position to help the members of his community by holding up an ideal that will make living conditions better in the future than they have been in the past. He should try to convince his neighbors that although in some districts, drainage may be the first step in successful crop production, the farmer's wife likes to have some other methods of carrying out dishwater than in a pail; that while it is important to keep the soil from blowing or washing off our farm, it is also necessary to provide equipment to wash it out of our clothes.

The reason that the foregoing remarks have been brought forward by way of introduction is that so many people seem to think that Agricultural Engineering is another term for Tractor Farming. The tractor is only one small item in the study of this subject and its application of engineering problems to farm life.

Many colleges have not awakened to the importance of the work and even at this time some colleges conduct the little agricultural engineering they give under the department of agronomy. Agronomy covers a large and most important field and those in charge have plenty to do without being burdened with something in which they are not particularly interested. The writer is not making any plea on behalf of his own department because the importance of Agricultural Engineering is already well established and recognized in the United States. It has also an important place in Western Canada, more important than in the East. If this statement is wrong the writer is willing to stand corrected. Saskatchewan has a department of agricultural engineering in a college 10 years old, that compares most favorably with any other in North America. About 15 years ago the University of Nebraska graduated the first student with a Professional Degree in Agricultural Engineering, and it is interesting to note that last year a new Agricultural Engineering hall was completed at a cost of $300,000. The main part of the building has a frontage of 180 feet and is 76 feet deep. It is two stories in height and has a full basement. Besides there is a rear wing 84 x 140 feet, and a tractor testing plant, which contains the most modern testing appliances. Every tractor that is sold in the State of Nebraska has to go through a standard test and prove its worth.

The College of Agriculture at Ames is contemplating the erection of a new building for this work. This year there are 45 freshmen registered in the Professional Agricultural Engineering Course. When the writer visited Professor Davidson last summer at Ames there was a list of over 50 requests for men to fill positions in various lines of agricultural engineering work in the commercial as well as the educational field.

Cornell College of Agriculture at Ithaca, N.Y., is planning on a $500,000 Rural Engineering Building.

California has a strong division of Agricultural Engineering, and is devoting a considerable amount of time in training men to teach Farm Mechanics in the Rural High Schools of the state.

It is not the object of this article to suggest the amount of time that should be given to the teaching of the various subjects in this department, but rather to point out what should be covered.

In the first year a course in shopwork along with one in drawing should be given. The object in view is to impress upon the student the importance of accuracy and to give him a training that will be of use to him no matter in what he may specialize before or after graduation. Shopwork should not be purely a course in manual training, but exercises should be carefully planned so that they are applicable to problems met with on the farm. This is being emphasized very strongly at the present time. The object of a course in forge work is not to make each student a blacksmith, so that he will be able to shoe his own horse. This takes years of training.

Every agricultural student should be required to take a course in Farm Machinery. Sufficient space should be available so that a good display of farm machines can be kept for laboratory work. Such an exhibit is also of direct value to any Province. It offers farmers an opportunity of looking over and comparing different makes and types of machines. The writer is convinced that the exhibit of farm machinery at Saskatoon has been of inestimable service in the latter respect. Hundreds of new settlers have come there for advice. Lectures in farm machinery and farm motors can be greatly improved by having the machines that are under discussion in front of the class. It is not

surprising that students often have difficulty in grasping quickly what is said in the class room when the machine is not there. To tell how to adjust the rear furrow wheel of a high lift gang plow without showing how the adjustment is made and why it is made, will be for the most part wasted effort. The same applies to seeding, harvesting and threshing machinery. To any who think there is no use teaching the subject to all let me quote from a recent Wisconsin circular entitled "It Pays to House Farm Machinery". — "It takes a million dollars a year to pay for the damage done to farm machinery which stands out of doors in Wisconsin. At least 10 per cent of the state's $100,000,000 worth of machinery is exposed to rain, sun and snow." Director Russell then gives a specific example:—"On a trip of 50 miles the other day through a section of the state where land is now worth $250 to $300 an acre, and where that watch tower of prosperity—the silo—was found on almost every farm, I saw from the car window, this machinery in the field, where it had been dropped at the end of the day's work and left to rust:

1 grain binder	3 corn binders
1 tractor	1 wagon
3 mowers	2 gang plows
2 disc harrows	2 hay rakes
1 hay loader	1 side delivery rake
1 manure spreader.	

It would cost $3,200 to buy this machinery today. The way in which it was being neglected would reduce its "life" fully two-thirds.

"A penny saved is two pence clear. A pin a day is a groat a year. Save and have."

A trip across Canada on a transcontinental line would bring before us similar scenes in every Province. If the students that go forth from our College halls can help to redeem some of this loss surely the results will justify the effort to take better care of this investment.

In farm motor work we come to the most interesting subject from the student's viewpoint. He usually knows something about a small engine at least, and there seems to be a fascination in seeing the wheels go round. There are fundamental principles to be taught the world over, but each college has to decide for itself how best it can serve the country in which it is located. For example, in California, great confidence is placed in tractors. Why? The California farmer uses more mechanical power than animal power. On Sept. 1 of last year he had in service 17,380 tractors, 33,550 electric motors, over 45,000 stationary gas engines, and a large number of motor trucks. The causes generally assigned for the extensive use of tractors in this state are: A twelve-month working season; large ranches requiring plowing, seeding and harvesting in a limited time; orchards requiring frequent cultivation; cheap fuels, and the very hot summer months prevailing in some parts of this state, making the use of horses almost impossible.

In Western Canada this would be more strongly emphasized than in the East. But as I have said before, the tractor is only one small portion of the agricultural engineering field. Horse drawn plows cause just as much trouble and are just as little understood as those drawn by tractors.

Farm Buildings or Rural Architectural work should include a discussion of the strength of materials, farm layouts and the planning of farm buildings. The problem of ventilation, heating, lighting, water supply and sewage disposal, are all equally important to the agricultural student. We could continue this discussion at great length, but enough has been said to show that there is plenty of opportunity for the application of agricultural engineering information.

The opportunity for Extension service in this department of agricultural education is unlimited. In a new country we will require better farm buildings, and people will have to be instructed in the advantages of using labor saving devices. To enthusiasts of tractor farming let me quote the following sound advice: "Not until valve grinding and adjusting bearings become as familiar to the farmers as shortening a tug, will the monkey wrench replace the currycomb," and further let me say that not until a man is prepared to spend as much time taking care of a small tractor as he is willing to give to the care of a four horse team, can he hope for any success. A large tractor manufacturer told the writer that three years ago they sold 50 tractors, and it required the services of 8 experts to keep them running, while last year they sold 325 machines and with only 4 men. Over 50 per cent of those who purchased them never asked for any help and had no trouble. This shows that education and only education will help with the solution of the power problem. One man in writing says: "The university authorities should be educated to the difference between the type of short course that requires simply a lecturer, a blackboard and a piece of chalk, where the only limit to the enrollment depends upon the range of the speaker's voice, and the tractor short course, where the necessary equipment is measured in carloads and the students, after hearing and seeing, immediately clinch the principles by applying them in practice work. This limits the students per instructor and increases the complication and cost of the school."

Manitoba Agricultural College has given courses in the various branches of this subject since the college started 15 years ago. Saskatchewan has received splendid support in carrying on this work. Courses in Farm Mechanics work are given in the various agricultural schools in Alberta and a Department of Agricultural Engineering has been organized in the University of Alberta. So much for the West. What is being done East of the Great Lakes? We, in the West, do not know. Perhaps someone will write and tell us. We are, or ought to be, much interested in attaining some degree of uniformity in the carrying on of teaching, extension and research work in Agricultural Engineering in Canada.

The growth and development of our country is the result of its agriculture, and has been in proportion to the development of the implements that are used in crop production. We are often told and read, that engineering has played no part in agriculture. The fact of the matter is that one American or Canadian farmer can grow as much wheat as forty Chinese farmers, which leads us to think a little before subscribing to such a statement.

It might also be said that no branch of engineering whatever is any more necessary than is this branch of Agricultural Engineering. It deals with the necessities. It deals with tractors, with plows, harrows, seeders, mowers, binders, threshers, silo fillers and all farm machinery. It deals with drainage. It deals with building construction, ventilation and sanitation.

It is a field that is beginning to receive the recognition it deserves, because of the industry it serves.

Wool Salesmanship on a National Basis

A. A. MacMILLAN, Live Stock Branch, Ottawa.

The sheep industry in Canada appears to be in a very healthy condition. All through the war there was a gradual expansion, but improvement kept pace with increase in population, and better prices brought about by a closer study of sheep management and methods of improvement. This year, although the wool market dropped back almost to prewar prices, most of the clip was marketed before the real drop came. Again the price of lambs remained almost at a level of 1919 values, and this helped to maintain confidence. A number of sheep men sold out; these for the most part were plungers and are now probably wishing they were back in again. In Western Canada there is a growing tendency for the homestead farmer to establish a small flock, so that there does not seem to be any undue evidence of panic, and there is every possibility that the sheep industry will continue to expand in a normal healthy fashion.

The sheep breeders in the Dominion have brought into being perhaps the most extensive and most efficient marketing and selling agency for the sale of any one agricultural product that exists anywhere in the world today. The extent of this organization reaches from the most outlying point in P. E. I. on the Atlantic Coast to the Islands of B. C. on the Pacific Coast, and from the boundary line on the south to the most northerly point where sheep are kept. In its make-up it maintains the autonomy of the local association, whether of county, district or Provincial scope. In its business relations it markets wool for every province in the Dominion. In its management each province plays a part in direct proportion to the extent of its sheep industry, and its patrons share its dividends in direct ratio to the extent of their consignments.

In these days of progressive co-operative activities the growth and development of such an enterprise is deserving of close study, especially when we consider (1) that it came into being in a country that at the time of its inception had scarcely three and a half million sheep, (2) that sheep have never been considered one of our most prominent classes of live stock and (3) that the country itself is of tremendous proportions, necessitating for many of the provinces long and costly hauls by rail. In addition,

Scene in the early stages of wool grading.

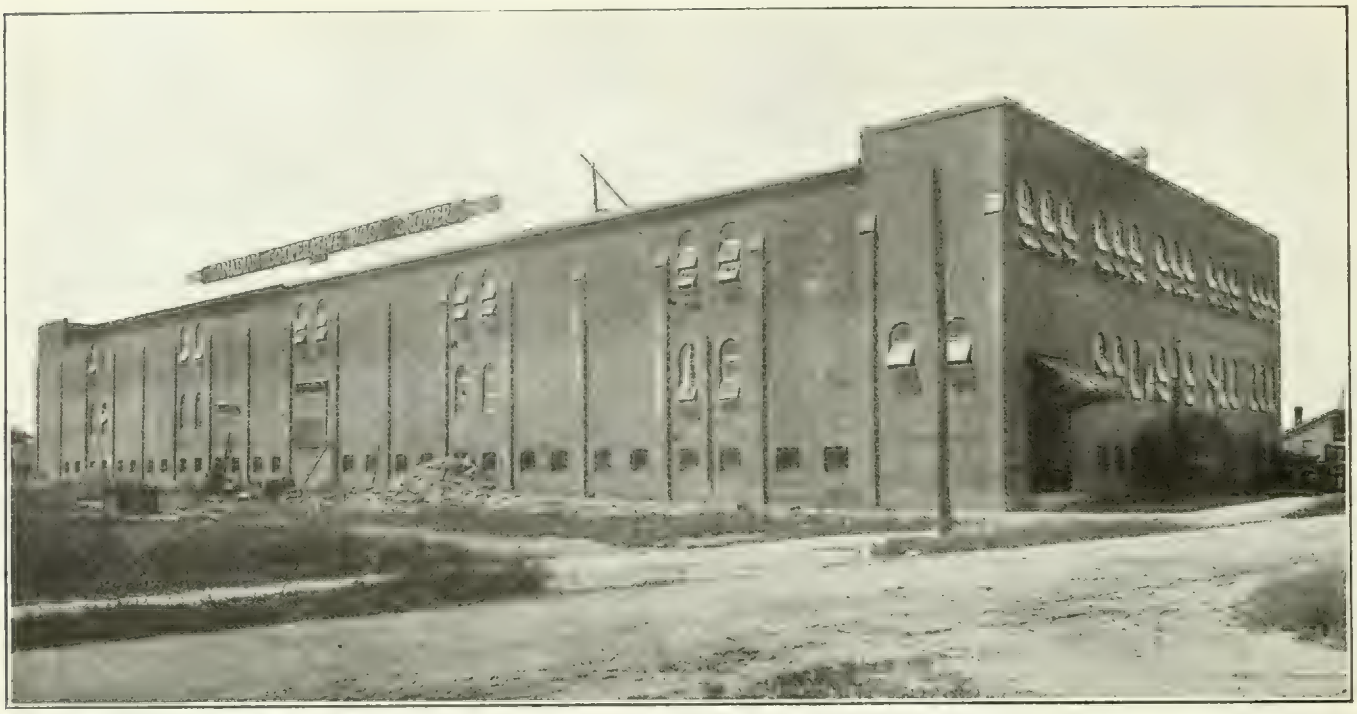
although Canada had laid the foundations of a woolen manufacturing industry, a very small proportion of Canadian mills used Canadian grown wools and few of the people were willing to wear woolen goods made from the wool of Canadian sheep.

One of the main reasons for the success of this enterprise was that it grew from the ground up rather than from the head down. Owing to the fact that in the ups and downs of the Canadian live stock industry the sheep was carried largely as a side line in the early days to provide wool for the homespuns and latterly to destroy weeds, clean up waste land and provide pocket money for the farmer and his wife. Farmers in the main paid little attention to wool improvement or preparation for market and markets. The result was that Canadian wools were classed among the poorest in the world and brought the lowest price.

From 1910 to 1913 a new interest developed in sheep raising, owing to a gradual increase in the price of lambs and a slight increase in the value of wool. Farmers, however, were not satisfied with prices obtained, and when in 1913 the Live Stock Branch employed a wool grader for the first time there was a ready response by the organization of several local associations and a few thousand pounds of wool were graded and sold co-operatively. The results were so satisfactory that in a year or two Wool Growers' Associations were operating in every Province of the Dominion. Provincial Departments of Agriculture, Agricultural Representatives and Agricultural Colleges, as well as the Dominion Department of Agriculture rendered assistance in the extension and consolidation of these local associations. Wool dealers were keen competitors of the local associations, but invariably the association won out in price, although operating expenses were of necessity kept very low. The competition of the wool trade generally developed a keen business aggressiveness on the part of the executive of the various local organizations, besides creating a spirit of loyalty on the part of their members.

In 1918 there were some thirty wool growers' associations operating throughout the Dominion, nearly all having had several years of selling experience. The advantages of grading and co-operative sale now went without question. However, some of the associations were far removed from their natural markets and others felt keenly the competitive strain of the old trade agencies. By this time a vast improvement had been effected in the wool qualities of the various provinces, both by breeding and by preparation for market. The time seemed opportune for organization on a national basis, and in February of 1918 a conference of representatives from all the associations was called for this purpose, result-

Field Demonstration for Wool Improvement



Central Warehouse of the Canadian Co-operative Wool Growers, Ltd., Weston, Ont.

ing in the organization of the Canadian Co-operative Wool Growers, Ltd.

The new organization came into being with a constitution which, as already stated, permitted all the local associations to retain their identity and local autonomy, thus maintaining their full confidence and support. Local management had developed keen executive ability and the keenest, ablest and most experienced were placed on the executive and directorate of the new organization. Previous experience had demonstrated the value of business ability and salesmanship and here again picked men were selected for these important positions. The principle of co-operation was adopted in its entirety and applied to both the management and disposal of dividends. It was agreed that sales for product consigned were to be made on the grade and quality basis. The organization was to be self sustaining in every detail except that it solicited the moral support of Governments, both Provincial and Dominion.

The success of the enterprise is now more or less definitely established. The business has grown from 3,500,000 pounds in 1918 to over 5,000,000 pounds in 1920. The year 1919 saw the beginning of the first real difficulties for the new enterprise. Prices commenced to fall and a portion of the 1919 clip remained unsold. However, the year 1920 demonstrated the real benefit of a Dominion-wide organization for Canadian sheep raisers. Early in the season the regular trade agencies ceased to operate almost entirely, owing to market uncertainties. The Canadian Co-operative Wool Growers, Ltd., were able to negotiate for an advance on wool to farmers of 15 cents and 20 cents for Domestic wools and 20 cents and 25 cents for Range Wools. After consignment and grading the wool was offered to the trade throughout the entire season and sales were effected from month to month. Previous to December 31st, 1920, some 3,400,000 pounds of wool were sold and since Jan. 1st, 1,800,000 pounds have been disposed of. At the present time all of the 1920 consignment has been sold except a few thousand pounds, a large proportion at exceptionally good figures and all of it at satisfactory prices to growers, considering the general market conditions throughout the season.

Of last years' clip 45 per cent of graded wool was sold to Canadian mills, 51 per cent to U. S. firms and 4 per cent to British buyers. The effect of being able to sell all co-operative consignments for 1920, when other countries still have vast surpluses of wool on hand, is a conclusive proof of the feasibility of co-operative enterprise on a Dominion-wide scale and should do much to give greater confidence to other co-operative institutions. The effect on the sheep industry has been productive of greater confidence and renewed interest and will undoubtedly be a prominent contributing factor to a permanent and gradual growth of sheep raising. The farmers' marketing organization has come through the reconstruction period with a good business record. Their financial position is secure and therefore they may be considered a permanent monument to cooperative enterprise that will continue to render equally as good service for the future as has been given in the past.

EDITOR'S NOTE.

A continuation of the foregoing article, under the title "Wool Grading as it Affects Canadian Wool Sales" will appear in our April issue, with suitable illustrations. The two articles represent the revision of an address given by Mr. MacMillan to members of the Canadian Society of Technical Agriculturists at a recent meeting held in Ottawa.

English Agriculture in the Seventeenth Century

DEAN E. A. HOWES, University of Alberta, Edmonton.

(An address before the Provincial Fairs and Dairy Associations, Calgary, February 17, 1921.)

Anyone who has been following closely the trend of agricultural thought during the years which have succeeded armistice cannot help but be impressed with the fact that there is a great forward movement in the interest in and enthusiasm for research work in agriculture. At the large gathering of Technical Agriculturists held at Ottawa last year this thought was doubly impressed upon me. During all the meetings the discussions seemed to hark back to the necessity for more investigation and experimental work, and there was a spirit of frankness throughout that gathering shown by a readiness to acknowledge that experimental work had not progressed during the years past as it should have done. This frankness is itself indicative of a keener interest being manifested by practising farmers in the work of experiment and its value to the farming communities. Of the many hundreds of farmers who have visited us at the University during the past year, a surprisingly large percentage have shown a keen, constructive interest in the experiments we have been carrying on and in the application of these to their own conditions. There is no gainsaying the fact that experimental work in all departments of agriculture is experiencing a sort of reincarnation since the close of the war. Nor is the cause far to seek. It is not in agriculture alone but in practically all fields of human endeavor that we find the practices of our people jarred loose from the restraints of old precedents. Many have said that there seems to be something in the air; whatever it is, something has taken place, and things can never be as they were before 1914. I assure you this is particularly true in the field of agriculture. Then, too, the war gave a decided impetus to inventive thought and while this was particularly true toward the front, it was true as well where men were laboring in works of production, and the more progressive farmers have undoubtedly caught the spirit which urges one to see if a thing can not be done in a better way or to more purpose. Hence the great interest shown all over our continent at present in work of investigation.

It is my wish, in this address, to take you with me on an excursion into the history of past research work, and to lay before you the experience of a people four hundred years ago who went through very much the same experience as we are going through at present, although of course not over such a wide-flung space. In the latter part of the sixteenth century a great change was taking place in English agriculture. Farming instead of being of the community type had developed into a condition where individual effort was fostered. Then came the Civil War, the war between Cavalier and Round Head. It is a fact that this war did not have much effect on the farming community, but I mention it to fix the period in your minds.

There was, in the early part of the seventeenth century, a very pronounced surge forward in the interest in agriculture, and consequently in the interest in experimental work relating to it. I might call your attention to the fact that this was probably the first indication of a really scientific attitude toward the work of agriculture. It is true that a study of the History of Agriculture shows us that men have long ago perfected practices sometimes in a way that we of the present day have not been able to equal. But the very minute that they attempted an explanation of these practices they became, as one writer said, pagans. We do not know just when scientific investigation really began in England, but we do know when the first records appeared and I would call your attention, by way of illustration, to the fact that in 1610 we find a discussion on the subject of irrigation, although it dealt only with meadows and pastures. In 1638 treatment of seed before sowing was recommended, treatments which show that the writer must have studied the question from a scientific standpoint rather than from that of superstitious lore. At the same time he advocates sowing with wheat drills instead of broadcast, and the same man invented a drill for the purpose.

It is true that previous to 1600 there was no dearth of books on agriculture. Indeed the people seem to have been as prolific in the way of writing on things agricultural then as now, and the agricultural writers of those days earned distinction in that they produced a man who has been called "the first English Hack Writer." His number has become legion. But it is in the first half of the seventeenth century that we find writers taking what might be called a truly scientific attitude toward the work, and the two instances I have given you are but indicative of a great deal of advanced thought in this field. We find writers earnestly advocating that the Government should establish 'Colleges of Experiment," and let me quote you one of the reasons given: "Men do not know where to go if they want advice and to obtain reliable seeds and plants." I might say that in those days also there was advocated a scheme for conveying a knowledge of improvements in agriculture to the farmer, a sort of agricultural extension service to the farmer if you please. There was really a wonderful spirit of progress in the agricultural idea in the first half of the seventeenth century, a spirit to which the attitude at the present time is very kindred, being really only a repetition of other days and other times. Let us then study the history of that other period of progression and see if we can profit by it. It is a stupid man, indeed, who does not profit by the experience of others.

In that period of progress in agricultural science which I have roughly described as the first half of the seventeenth century, we find two things militating against any rapid advance in the effect of scientific discoveries upon agricultural practices. I cannot do better than quote a few words from two writers of that time. They will put before you the difficulties, and I shall leave it with you if the same

difficulties do not obtain, perhaps in a modified way, in the present day. Said one writer: "Some men object that new seeds will not grow here with us, for our forefathers never used them. To these I reply and ask them, how they know? Have they tried? Idleness never wants an excuse; and why might not our forefathers upon the same grounds have held their hands in their pockets, and have said, that wheat and barley would not have grown amongst us?" Another writer presents his tale of woe as follows: "The fourth and last abuse is a calumniating and depraving every new invention; of this most culpable are your mouldy old leavened husbandmen, who themselves and their forefathers have been accustomed to such a course of husbandry as they will practice, and no other; their resolution is so fixed, no issues or events whatsoever shall change them. If their neighbor hath as much corn of one acre as they of two upon the same land, or if another plow the same land for strength and nature with two horses and one man as well as he, and have as good corn, as he hath been used with four horses and two men yet so he will continue. Or if an improvement be discovered to him and all his neighbors, he'll oppose it and degrade it. What forsooth saith he, who taught you more wit than your forefathers?" I prefer to size the situation up in the wise and kindly words of a later agricultural writer who says, "It took a heavy hammer and many blows to drive a nail through the heart of oak." So much for the difficulties in the way of those pioneers in agricultural experiment and extension work. Let us look at the other side of the case.

Much of the delay of progress must be blamed upon the agricultural writers of those days. In the first place they were too impatient to have their new ideas put into practice by the farmers, and their language was often the cause of the very lack of appreciation of which they complain. No farmer of that day would care to be described as a "Mouldy old leavened husbandman" and one writer advocates compulsory legislation to force farmers "even like brutes to understand their own good." This language, to say the least, was imprudent, if the writer wished to get results. But that is only one phase of the story. To quote the words of a critic, "their promises were often exaggerated beyond the bounds of belief." The writers of that day are justly charged with the guilt of retarding agricultural progress, because they made such sweeping claims that in the mind of the practical farmer they bred distrust of all book farmers, no matter whether their claims were based upon actual experiment.

Let us take some examples. A very important crop was introduced into the country, one which had a good deal to do with revolutionizing English agriculture, and here is what an advocate of this crop has to say about it: "It is the only food for cattle, swine and poultry, sovereign for conditioning 'Hunting dogs,' an admirable ingredient for bread, affording 'two very good crops' each year, supplying 'very good Syder' and exceeding good Oyl." This crop was turnips and the date is 1659, not 1920. "Here is a remedy for trouble among live stock—place a piece of fern root under the tongue" Today we are more up-to-date and advocate potassium iodide. About the same time there were writers who advocated the odd special crop of enterprise—Black Foxes, Muskecats, even elephants were advocated by one writer.

Briefly, there appears to have been enough short-circuit scientists, hot-air artists and cranks in the agricultural world of that day to make the practical farmer look askance at what was written about his profession and the introduction of flax, turnips and clover coupled with new advances in agricultural practices, failed in what they might have accomplished because of these people, who claim they were trying to serve the needs of the agriculturists of that day. "Tusser, teaching thrift, never throve. Gabriel Plattes, the corn setter, died for want of bread. Donaldson, the author of the first Scottish agricultural treatise, admits that he took to writing books because he could not succeed on the land. Even Arthur Young failed twice in farm management before he began his invaluable tours."

All this presents a lesson so plain that he who runs may read. I firmly believe that we are on the threshold of a great advancement in agriculture practices because there is such a constructive demand for accurate and honest agricultural experiment. It may be true that new crops, new practices, all of these combined, are awakening public interest, but it is the spirit of the thing that counts, and if on the part of technical men of our Colleges and Departments we can restrict the too enthusiastic boosters and short-circuit scientists so that our farmers will have a desirable respect for what we publish and what we advocate, we shall be showing evidence of having profited by the mistakes of others. And to the farmers I would say that while I do not fear a repetition in our day of the old conservatism which bases everything on the practices of forefathers, I do fear that there is always a danger of your being lead away and confused by a possible multiplicity of advice on the part of the people who are in public places as your investigators and experimenters. In other words, I counsel you to separate the wheat from the chaff. Get your information from those who are directly concerned in experimental work or as nearly directly as you can get it. The Experiment Stations which have stood the test of time and which now enjoy the respect and confidence of all in touch with them are the few who have refused to issue statements without definite authority and experience back of them, and whose experiments have been carried on for at least five years before any definite conclusion has been drawn. The leaders in our various communities must shoulder a certain responsibility in that they should advise the people to be careful about new varieties, new crops, new treatments, until they have found out what reputable Experiment Stations have been able to report upon these. We need co-operation in this work of purging the enterprise of experimental service to the farmers from all that is spurious and superficial. We will never reach our goal entirely, but we will have the satisfaction of having tried for something which is worth while, and as our country becomes older, more settled and more standardized, the short-circuit artists will find the field harder and harder to work.

The Story of Spraying Mixtures

W. LOCHHEAD, Professor of Entomology and
Zoology, Macdonald College, P.Q.

(Presidential address at the 13th Annual Meeting of the Quebec Society for the Protection of Plants.)

Prior to 1860 the methods of protection of plants from insects and fungous diseases were extremely crude and primitive. Practically nothing was known about the nature of fungous diseases, and although insects had been studied for many years, no serious attempt had been made to control the injurious forms with chemicals. The best insecticides in use were various forms of soap, tobacco, quassia chips, carbolic acid and hellebore.

As we all know, spraying mixtures are of two kinds:—*Insecticides* and *Fungicides*, but some mixtures, like lime-sulphur and soluble sulphur, belong to both groups.

Insecticides.

In the development of insecticides, as of other phases of economic entomology, the United States has taken the lead over all other nations. Two outstanding factors contributed to this wonderful progress:—1. The losses which certain portions of the country suffered at various times from (a) the potato beetle; (b) the Rocky Mountain locust; (c) the cotton caterpillar; (d) the San José scale; (e) the cotton-boll-weevil; (f) the Gypsy and Brown Tail moths, brought public opinion to bear strongly upon Congress so that measures were taken to discover methods of control; 2. The establishment of State Agricultural Colleges and Experiment Stations which made it possible to train men for the investigation of such problems.

It is interesting to note that in the matter of insecticides, methods of fumigation with hydrocyanic acid gas, and spraying with lime-sulphur and resiny washes were developed first on the Pacific Coast, while arsenical sprays and mineral oil preparations were developed in the East.

Paris' Green.—Paris Green was the first insecticide of merit to be employed against biting insects. During the sixties, it came into use against the Colorado beetle, in the seventies it was successfully used against the cotton caterpillar and against canker-worms and the codling moth in orchards, and in the eighties against the plum curculio and other pests. By 1890 Paris Green had become the standard insecticide against biting insects. However, this and other arsenite compounds, like London Purple and the Kedzie mixture made from white arsenic, were soon found to be unsatisfactory on account of their liability to burn foliage unless great care were taken to neutralize the free acid present.

Arsenate of Lead.—In 1892 Arsenate of Lead was first employed against the Gypsy moth, and gradually gained favor as a substitute for Paris Green. It has the advantage of being harmless to foliage, of remaining well in suspension without constant stirring, and of sticking to the foliage for a long time. It can, moreover, be used with Bordeaux and lime-sulphur as a combination spray. As the paste form deteriorates on exposure, while the powder is quite stable, the latter is recommended for general use.

Sanders and Kelsall, of the Dominion Entomological Laboratory, Annapolis, Nova Scotia, have done some admirable work on the reactions that occur when arsenate of lead is mixed with other chemicals. For example, they found that apple foliage is liable to be injured when more than 15 mgms. of As_2O_5 are in solution per 1000 cc. of water. In the case of lead arsenate ($PbH\ AsO_4$) it is seldom soluble to the extent of 4 mgms. of As_2O_5 in 1000 cc., and on the average about 2 mgms. However, when the manufacturer adds a small amount of MgO to make it float better in water, a chemical reaction occurs which makes it dangerous to leaves. Magnesium arsenate ($Mg\ H\ AsO_4$) is formed, which dissolves to such an extent in water that 40 or 50 mgms. of As_2O_5 are to be found in 1000 cc. of water.

Again, when a very small quantity of lime is added to lead arsenate, a lime arsenate ($Ca\ H\ AsO_4$) is formed which is highly dangerous. But if the lime be present in large quantities $Ca_3(AsO_4)_2$ is formed which is not dangerous.

Arsenate of Lime.—During the last two or three years arsenate of lime has been employed by many growers as a substitute for the lead arsenates, on the score of reduced price and higher poison content pound for pound. It is, however, less stable, but with the addition of a stabilizer such as hydrate of lime, Bordeaux, lime-sulphur, or soluble sulphur, when excess lime is present, it is quite safe to foliage.

For the coming year arsenate of lime is being widely recommended as a cheap and effective substitute for arsenate of lead.

Lime-Sulphur. Perhaps the most outstanding achievement in commercial spraying during the last forty years has been the introduction and improvement of lime-sulphur. In the eighties the California fruit growers used it against both the scale and the peach leaf curl. As an insecticide against scale and many sucking insects, it has been employed ever since, but by the early method of preparation it had to be applied warm for crystals soon formed, which tended to clog both the spray pump and the nozzles. Moreover, it could be used only for the dormant or semi-dormant stage.

About 1912, a new method of preparation was discovered, which removed the objectionable features of the old method. It consisted in making a concentrated solution by boiling together 50 lbs. of fresh stone lime, 100 lbs. of sulphur and 40 to 50 gallons of water. The solution when properly made can be kept for months, and for use can be readily diluted to any strength required for dormant and summer spraying.

The discovery by Sanders and Kelsall of the cause of the heavy drop of the fruit after applications of lime-sulphur is worthy of note. They found that when lime-sulphur (1 to 30) was applied only to the upper surface of the leaf no injury followed, but when both sides, or only the lower surface, were sprayed injury was done. When sprayed leaves were examined microscopically, it was observed that the chlorophyll of the leaf-cells had been acted upon by an appreciable amount of lime-sulphur absorbed through the lower surface. They observed, however, that no such injury followed applications of Bordeaux and soluble sulphur.

The excessive dropping of the fruit, they maintain, is due to the injury to the leaves whereby they fail to function as carbohydrate manufacturers for the fruit. The greatest drop occurs after the fourth application, that is, the one given two weeks after the petals fall,

and has only become evident since the advent of high-pressure pumps and greater capacity nozzles.

Another important investigation by Sanders and Kelsall bore on the question of the influence of fungicides on the killing value of poison insecticides when the two are mixed together. They found that with Bordeaux the average poison is decreased in value by about 50 per cent. With soluble sulphur the value of the poison is increased from 10 to 15 per cent, and with lime-sulphur the decrease is about 20 per cent.

Kerosene Emulsion.—A solution of Kerosene Emulsion has long been a valuable insecticide against sucking insects. The standard formula (Riley-Hubbard) was originated in 1884, although several modifications have also appeared. When properly prepared Kerosene Emulsion can be applied with safety on most plants, but of late years tobacco extracts have taken its place.

Tobacco Extracts.—Tobacco dust and extracts have been used probably for more than a hundred years for the control of aphis and other sucking insects, but it is only within the last ten years that concentrated extracts of nicotine have been placed on the market. The best known of these are "Black Leaf 40", being a 40 per cent solution of nicotine sulphate, a non-volatile substance, and "Nicofume", a 40 per cent solution of nicotine in the volatile form. Black Leaf 40 can be combined with lime-sulphur, Bordeaux and arsenates of lead and lime as a 3-in-1 mixture, and is used at strengths varying from 1 to 800 to 1 to 1600 of water.

Fungicides.

It is not surprising that plant growers of two or more generations ago had difficulty in controlling plant diseases, since the nature of these maladies was not understood. One has but to peruse some of the old works on the nature and treatment of disease to find how crude were the conceptions of the early plant growers and botanists, and how far the modern plant pathologist has travelled during the last fifty or sixty years.

Three outstanding factors contributed to the great development of our knowledge of plant diseases and methods of control:

1.—The epochal investigations of European botanists on the causal organisms and their relation to such plant diseases as smut (1853), the potato-rot disease (1861), and wheat rust (1865).

2.—The rise of American investigators in the seventies and eighties, such as Burrill, Farlow, Arthur, Bessey, Halstead, Earle and others whose contributions added substantially to our knowledge of fungi and fungus and bacterial diseases.

3.—The work of the U. S. Department of Agriculture and of the newly established Agricultural College and Experiment Stations which gave a tremendous impetus to the study of plant diseases and control measures from 1885 onward to the present.

It is true that sulphur and powdered lime were often dusted upon the plants and gave some relief, but it is only since the discovery of Bordeaux in 1883 that the control of plant diseases has been carefully investigated. The plant pathologist has shown clearly that the fungicide should be applied just before the rain, not after. In the case of apple scab, for example, the spores are carried to the leaves during rains, and if the rainy spell lasts 48 hours infection will take place. To protect the leaves, therefore, the spray must be applied before the rain.

Again, the plant pathologist has shown clearly that a knowledge of the life history of the fungus is essential if best results are to be secured in spraying operations.

Lime-Sulphur.—Lime-sulphur has already been mentioned among the insecticides, but it is also one of the best fungicides. For a time after the discovery of Bordeaux mixture it was discarded, but in 1906 its importance as a fungicide was rediscovered, and ever since it has been employed extensively for the control of many fungous diseases of the orchard.

In Nova Scotia, however, the fruit growers observed that the calyx spray and especially the following spray were responsible for a heavy fall of fruit on account of its action on the leaves. For this reason they substituted in 1918 and 1919 a modified Bordeaux for the lime-sulphur.

Lime-sulphur is in the main a mixture of polysulphides of calcium. The fungicidal properties of lime-sulphur lie in the free sulphur that is formed on the surface of the leaves and fruit on the evaporation of the water and the oxidation of the polysulphides.

When trees have been drenched with the mixture injury is liable to occur, but under proper conditions little or no injury follows, except in the case of potatoes, American grapes and some varieties of peaches.

Bordeaux Mixture.—From the time of its discovery by Prof. Millardet, of France, in 1883 up to 1910, Bordeaux mixture was the standard fungicide for summer spraying. But with the rediscovery of lime-sulphur in 1906 as a summer spray, Bordeaux has been relegated to second place in commercial orcharding on account of the russetting of the fruit and the yellowing of the foliage that followed the standard application, made according to the formula 4:4:40.

The structure and composition of Bordeaux mixture has been recently ascertained. It consists of colloidal membranes composed of a complex mixture of basic copper sulphates, enclosing a solution of calcium hydroxide and calcium sulphate holding lime particles in suspension. The fungicidal properties depend on the number and size of the colloidal membranes and to the lime particles. The smaller the membranes, the more effective does the mixture cover the sprayed surface. When evaporation of water occurs the minute membranes dry down and attach themselves firmly to the surface. Then the copper in the membrane is slowly dissolved when the leaves become moist, and either kills or inhibits the germinating spores which lodge on the leaf. Moreover, it is believed that the lime particles are also fungicidal.

It will be seen, therefore, that the quality of the Bordeaux depends upon the method of preparation.

The minute membranes will never be formed when concentrated solutions of Copper sulphate and milk of lime are brought together. On the other hand, they will be formed when vigorous stirring takes place when the dilute solutions are brought together.

Reference has already been made to the peculiar conditions in Nova Scotia, which compelled the fruit growers to return to a modified form of Bordeaux where lime is used in excess. In 1919 they used the 3:10:40 and the 2:10:40 formulae with gratifying results.

Dust Spraying.

While dust spraying was probably employed before liquid spraying, it was superceded by the latter when Bordeaux mixture and Paris Green became the standard spraying materials. However, as fruit growing was developed more extensively, and intensively as well, the factors of economy of time and cost of equipment in spraying operations assumed more importance, and efforts were made by the more progressive men to meet the needs of the industry by devising more economical methods of spraying.

About 20 years ago sulphur dusting was tried occasionally on grapes, but about 1911 orchard experiments in dusting were begun in New York State by Cornell Station. These were continued for about seven years or until it was conclusively demonstrated that dusting was both efficient and practicable, and a satisfactory substitute for liquid spraying.

Nova Scotia furnishes an interesting example of changing methods in spraying, due to the investigations by Messrs. Sanders, Kelsall and Brittain. These gentlemen have devised improved mixtures for both liquid and dust spraying. Up to 1912 Standard Bordeaux was the fungicide used by the fruit growers; then lime-sulphur was substituted. When this proved unsatisfactory a modified Bordeaux with an excess of lime was employed.

Dusting was introduced about 1916, and gradually made headway with improvements in the manufacture of dust products. In 1918, 1919 and 1920 the 90-10 sulphur arsenic dust (90 per cent sulphur and 10 per cent lead arsenate) and copper arsenic dust (10 per cent copper sulphate, 5 per cent arsenate of lime, and 85 per cent hydrated lime) were used. In 1921 both the sulphur and the Bordeaux methods will be used by the fruit growers of that province.

Up to 1920 no dusting material has been found that controlled sucking insects satisfactorily, but the 1920 experiments in California against the Pear Thrips, with 5 per cent "Nico dust" which contains 5 per cent Black Leaf 40 and pulverized Kaolin, and those in Nova Scotia against psyllids with nicotine sulphate with sulphur and arsenate of lead, give strong hopes that the difficulty has been largely overcome. It will be possible for the future to use a 3—in—1 combination dust against fungi and biting and sucking insects.

In this very incomplete review an attempt has been made to make clear the chief outstanding events in the story of spraying mixtures. These are:—

1.—The use of Paris Green against biting insects, between 1860-1870.
2.—The introduction of Bordeaux mixture as a fungicide, about 1885.
3.—The introduction of lime-sulphur, first as a contact insecticide and later as a fungicide in 1906.
4.—The use of lead arsenate and calcium arsenate as insecticides against biting insects.
5.—The use of Kerosene emulsion and tobacco extracts as contact insecticides.
6.—The practicability of combining the more important insecticides and fungicides in one mixture for spraying purposes, thus saving much time in spraying operations.
7.—The manufacture of spray materials in finely powdered form and the introduction of dust-spraying, making for much saving of time.
8.—A better knowledge of the chemical reactions that occur when different spraying materials are brought together, and of the physiological action of these mixtures on the leaves of plants.
9.—A better knowledge of the life history of insects and fungi, so that the spray applications are made at times when they will be most effective. In other words, the spray calendars are now based on the stage of development of plant, insect and fungus, and not as formerly on the almanac.
10.—Closely connected with developments in spraying is the development of spraying outfits, which this paper does not attempt to discuss.

In conclusion, it is a pleasure to note the part taken by Canada in the story of spraying mixtures, although she has in most cases followed the lead of the United States and Europe.

Mention has already been made of the splendid investigations carried on in Nova Scotia by Sanders, Kelsall and Brittain in connection with lime-sulphur injury, and with the making of dust mixtures, but credit should be given to Saunders and Reed, of London, Ontario, for their early experiments (1871)) with various chemicals for the control of the potato beetle, to Cline of Winona and McMichael of Waterford for their experiments with orchard insecticides and funguicides from 1883 to 1887, to Prof. Craig of the Dominion Experimental Farm for experiments on the control of apple scab and other diseases with Bordeaux and other fungicides (1890-1894), to Dr. Fletcher for his experiments on the control of many injurious insects, and to the Ontario Agricultural College for experiments with lime-sulphur and other substances against the San Jose scale.

LITERATURE.

Lodeman, E.G.—The Spraying of Plants—Macmillan, 1896.

Howard, L. O.—Progress in Economic Entomology—Year-Book, U.S. Dep. Agric., 1899.

Galloway, B. T.—Progress in the Treatment of Plant Diseases in the United States.—Year-Book, U.S. Dep. Agric., 1899.

Fulmer, H. L. & Caesar, L.—Lime Sulphur Wash—Bul. 177, O. A. C., 1909.

Crandall, C. S.—Bordeaux Mixture—Bul. 135, Ill. Agr. Exp. St. 1909.

Harcourt, R. & Fulmer, H. L.—Insecticides and Fungicides, Bul. 195, O. A. C., 1912.

Lutman, B. F.—Some Studies on Bordeaux Mixture—Bul. 196, Vermont Agr. Exp. St., 1916.

Reddick, D. & Crosby, C. R.—Dusting and Spraying Experiments with Apples—Bul. 369, Cornell, 1916.

O'Kane, W. C. et al.—Arsenical Residues after Spraying, Bul. 183. New Hamphire Agr. Exp. St., 1917.

Petch, C. E.—Dusting Experiments—Rep. Ent. Soc., Ont., 1916, 1917.

Caesar, L.—Dusting Experiments—Rep. Ent. Soc. Ont., 1916, 1917.

Sanders, G. E.—Apple Spraying, Rep. Que. Pom. Soc., 1917.

Lochhead, W.—Class Book of Economic Entomology—Blakistons, 1919.

Whetzel, H. H.—History of Phytopathology, W. B. Saunders Co., 1918.

Sanders, G. E. & Kelsall, A.—Proc. N.S. Ent. Soc. 1919.

Brittain, W. H.—Spraying and Dusting—Report N.S. Fruit Growers Assoc. 1920.

Whetzel, H. H.—The Present Status of Dusting—Proc. 2nd. meeting N.Y. State Hort. Soc., 1920.

Whetzel, H. H.—Spraying—Dep. Circ. 20, Mass., 1920.

Sanders, G. E. & Kelsall, A.—Dusts and Dusting for Insect and Fungus Control—Sci. Agric., Vol. I. No. 1, 1921.

Some Notes on the Fruit Worms of British Columbia

By R. C. Treherne, Entomologist in charge for British Columbia, Dominion Department of Agriculture.

Owing to the similarities that exist between the various fruit-infesting larvae attacking orchard trees in Canada, the following notes are given to assist field inspectors, horticulturists and entomologists in the ready determination of species. The importance of this study is particularly essential so far as British Columbia is concerned, owing to the absence, at the present time, of the Oriental Peach Moth and the comparative scarcity of the Codling Moth within the province, and in as much as it may assist in the rapid determination of larval identity.

The following fruit-infesting insects, liable of confusion with the Codling Moth, have been taken in British Columbia, and they fall according to Fracker (Illinois Biological Monograph, 2, No. 1, 1915) whose method of larval determination has been followed in the main, into the following groups:—

Tortricinae—*Tmetocera ocellana.* The Apple Bud Moth.
Cydia pomonella, The Codling Moth.
Peronea (Acleris) maximana.
Archips (Cacoccia) rosaceana.
Archips (Cacoccia) argyrospila.
Enarmonia prunivora, The Lesser Apple Worm.

Gracilariidae—*Marmara pomonella.* The Apple Fruit Miner.

Gelechiidae—*Anarsia lineatella.* The Peach Twig Borer.
Aristotelia fragariae. The Strawberry Crown Borer.

Œcophoridae—*Epicallima dimidiella.*

Pyralidae—*Plodia interpunctella.* The Indian Meal Moth.
Mineola tricolorella.

Geometridae—*Rachela bruceata.* Bruce's Measuring Worm.

Key to Certain Families (adapted from Fracker).

A. Thoracic legs wanting or mere fleshy swellings; body never fusiform; ocelli six or one on each side; body often depressed .. .. Gracilariidae.

AA. Thoracic legs present. Prolegs always present but when reduced represented by at least rudimentary crochets; body having no tufted or secondary setae; prolegs not bearing more than four or five setae; crochets usually arranged in a circle or in transverse bands; epsilon on prothorax always below alpha and gamma.

B. Kappa group on prothorax bisetose, theta absent; crochets usually biordinal .. .. Pyralidae.

BB. Kappa group on prothorax trisetose, theta present.

C. Crochets arranged in two uniserial transverse bands on each proleg, those of anal prolegs in two groups. Gelechiidae.

CC. Crochets arranged in a uniserial circle; pi group on mesothorax unisetose.

D. The setae beta closer together on segment 9 than on any other abdominal segment, usually on the same or adjacent pinacula .. .. Tortricinae.

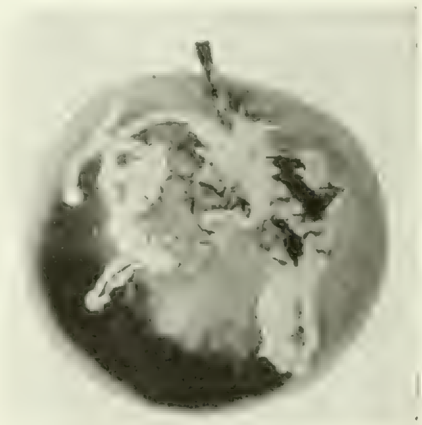
DD. The setae beta at least as far apart on segment 9 as on any other abdominal segment, never borne on the same or adjacent pinacula.

E. Crochets biordinal; fourth ocellus much closer to third than to the sixth, second closer to third than to fourth .. .. Œcophoridae.

EE. Third ocellus not so closely associated with second and fourth .. .. Gelechiidae.

The Apple Fruit Miner, *Marmara pomonella,* may be readily distinguished from all other fruit-infesting insects by its fruit mining habits, galleries being formed between the flesh of the fruit and the skin. This insect has been recorded from the Lower Kootenays and from Sorento, both localities being in the humid transitional areas of British Columbia.

The Pyralidae, as pointed out in the foregoing key, may readily be distinguished by the bisetose kappa group on the prothorax. Furthermore the pi group on the mesothorax agrees with Fracker in being unisetose, and kappa and mu on abdominal segment 9 while associated with eta in the specimens here examined is not necessarily on the same pinaculum. The two species mentioned in this group have both been received at the laboratory, from field collections, in mistake for Codling Moth larvae, in that both species have been taken in fruit on the trees and under bands of burlap in the quarantined Codling Moth areas. *Mineola tricolorella*



Work of the Apple Fruit Miner (Marmora pomonella) on apple. (Original.)

was found to cause a feeding area on the surface of the fruit very similar in appearance to the work of the Lesser Apple Worm or even 'side-worm' Codling Moth, in that a small hollowed-out area was produced just beneath the skin. Full-grown larvae 12 mm. in length, have been taken in the field within apple fruit, feeding at the core and destroying the seeds, and the channel from the surface feeding-area to the core while somewhat winding in nature was definite in outline. Fifteen larvae of this species have been taken in two years in the vicinity of Vernon, B.C. on the habits of which the above notes have been taken.

Larval characters. *Mineola tricolorella.*

Mature larva 12 mm. in length, of even breadth, cylindrical, reddish-brown in colour, darker on the thoracic segments. In lateral aspect the ventral surface is distinctly lighter than the dorsum. Head reddish-

brown; basal joint of antenna dark brown, apical joint pale brown; mouth parts pale yellow; acelli pale yellow on a dark brown area, the three ventral ocelli forming an equilateral triangle; clypeus pale yellow; labrum dark brown. Thoracic shield about concolorous with head, slightly paler on the anterior margin. Thoracic legs very dark brown. Anal plate pale reddish-yellow, slightly paler than the remainder of the dorsum. Tubercles inconspicuous. Seta eta frequently not contained on the same pinaculum as kappa on prothorax. Setae kappa, eta and mu on the 9th abdominal are separated and not necessarily contained on the same pinaculum.

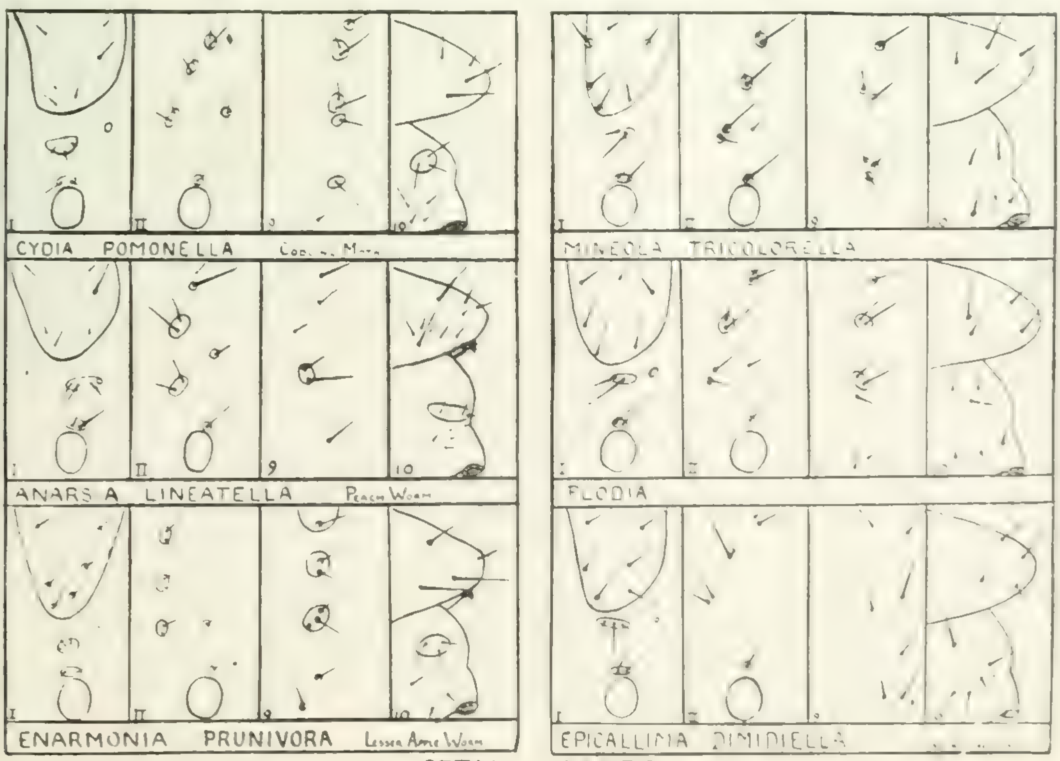
The larvae of the species of *Plodia*, which has been determined as *interpunctella*, have been received on many occasions in mistake for the larvae of the Codling Moth. They have been taken frequently under burlap bands on apple trees in Codling Moth quarantined areas, occasionally in apple fruit on the trees, but most commonly in dry cull apples left as refuse in the orchard out-of-doors and in the packing house. Specimens have been received from all parts of the Okanagan valley and their size and colour may easily cause confusion with Codling Moth larvae. It is easy to understand that larvae that frequent refuse in an orchard may readily adopt the burlap bands placed around apple trees for Codling Moth larval traps, as wintering quarters in the autumn of the year. It is a matter of no surprise, therefore, to receive such larvae from field inspectors as ostensible Codling Moth larvae. It is surprising, however, to find larvae infesting mature apples in the field. On several occasions we have found nearly mature larvae in well defined tunnels, at least 8 mm. deep in the flesh, in fresh fruit. We have not been able to prove that such larvae were not using some gallery previously formed by some other insect, but we have undoubted proof that these larvae feed freely on the flesh of fresh fruit on the trees. The presence of fresh frass in such galleries with the larvae is sufficient evidence of the truth of this statement. Confirmative evidence has also been obtained by laboratory experiments, but such laboratory tests incline us to the belief that the fruit infesting habit is not normal. However, in view of the fact that an occasional larva may infest apples, and so cause confusion in the matter of identity, the following description is given of a mature larva:—

Plodia interpunctella. Length 12 mm. General colour creamy to pinkish white, the last three abdominal segments often paler than the remainder of the body. Head orange to orange-brown and of a uniform colour with the exception of the mouth parts which are dark brown. Thoracic shield lighter in colour to the head, almost transparent white along the anterior margin. Tubercles on body prominent and often pigmented brown. The bisetose kappa group on the prothorax readily separates this larva from the Codling Moth.

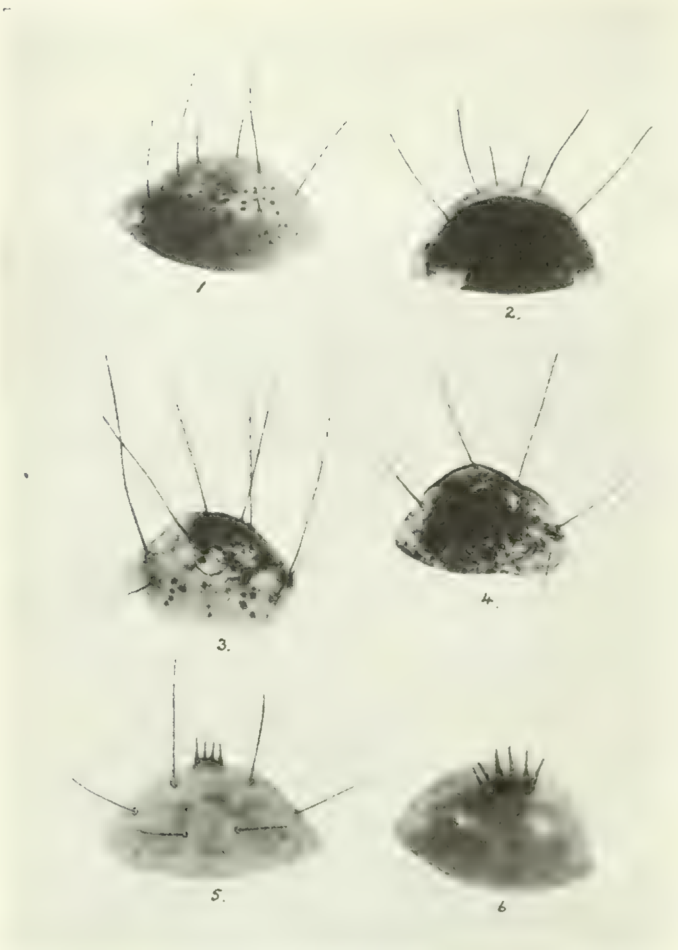
The two species of the Gelechiidae may be readily separated from one another by their different food plants as their common names imply. *Anarsia lineatella* may, however, be confused with the Codling Moth and other fruit-infesting insects and for this reason may be dealt with briefly. The Gelechiidae may be recognized by the trisetose kappa group of the prothorax and the width between the setae beta on the 9th abdominal segment in relation to the other abdominal segments.

Larval characters. *Anarsia lineatella.*

Mature larva measures half inch in length, cylindrical in outline. General colour reddish-brown with head, prothoracic shield and anal plate black. Intersegmental tissue dull white in colour. Anal plate furnished dorsally with many hairs of varying lengths. Anal fork present, almost black in colour, with divergent teeth bifurcated at the tips. Spiracle on segment 8 of the abdomen very large. Prolegs short with well developed crochets arranged in a pair of transverse bands, usually biordinal, those on anal prolegs in two groups. Spiracle on prothoracic segment usually contained on the kappa group of setae. Kappa and eta on 9th abdominal segment combined, mu absent.



SETAL MAPS



Terminal abdominal segments of certain fruit-infesting insects: (1) Codling moth. (2) Tmetocera ocellana, (3) Plodia interpunctella, (4) Mineola tricolorella, (5) Lesser Apple Worm, (6) Anarsia lineatella. (Original micro-photographs by M. H. Ruhmann.)

The next group, the Œcophoridae, is so closely related to the Gelechiidae that there is difficulty in differentiating the larvae. The only species with which we have to deal in this paper is *Epicallima dimidiella* which by reason of the fact that it is always taken under bark and in places frequented by other fruit infesting larvae may possibly be mistaken for the Codling Moth. This species which appears to be very common in the vicinity of Vernon, B.C. is a refuse feeder and has never been observed to leave the crevices of the bark or to attack fresh fruits. It is, therefore, except in the matter of the confusion liable to arise in comparison with the Codling Moth, easily recognized. Mature and partly-grown larvae winter in cracks and crevices of apple tree bark, much in the same way as does the Codling Moth, and emergence of the moths occurs from the middle of May until July. The eggs have not been observed but they are doubtless laid in bark crevices, for the reason that young larvae may be seen in their typical habitat during August.

Larval characters. *Epicallima dimidiella.*

Mature larva 7.5 mm. in length. General colour dull grey, with a sub-dorsal line on each side composed of a series of small spots of a semi-transparent appearance. These markings are absent on abdominal segments 9 and 10. The ventral surface of the body is pale grey, almost white in colour. The head is pale brown, shiny, with darker mouth parts; lateral ocelli black. Thoracic shield dull grey-black divided by a central longitudinal pale line, with five small well-defined spots, semi-transparent, arranged in the form of a crescent. Anal plate dull grey-black, bearing eight pale yellow setae.

The pupa measures slightly less than 5 mm. in length and is of a straw colour with a dark brown cremaster.

The only species of Geometridae to which our attention has been drawn is *Rachela bruceata.* These larvae may cause surface injury to fruit and on account of their somewhat gregarious habits in their earlier stages may be mistaken for more important fruit-infesting insects. They are, however, typical leaf feeders and being possessed of only two pairs of prolegs, whence arises the name of 'measuring worms', they are distinctive larvae.

It is with the various members of the sub-family Tortricinae, mentioned in this report, that most confusion is liable to arise in the matter of larval identity.

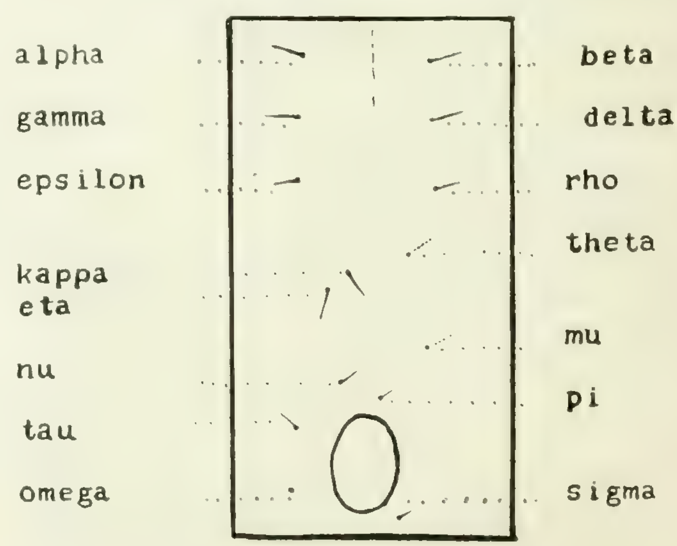
Archips rosaceana may be readily separated from its allies by reason of its green colour and the fact that the larva does not bore into fruit but produces a large rough surface feeding-area, which causes malformation.

Larval characters. *Archips rosaceana.*

The mature larva measures 19 mm. in length. General colour dark velvety green, paler on the ventral surface. Head variable in colour from black to dull-brown; mouth parts pale brown. Thoracic shield concolorous with head, also variable in colour, divided by a narrow median line of pale green. Anal plate slightly paler than the dorsum, mottled on the anterior margin with five irregularly arranged grey blotches and bordered laterally with a narrow band of grey. Spiracles circular, ringed with dull brown. Thoracic legs black, ringed at base on the anterior margin with a dull brown plate. Tubercles slightly paler than the general surface of the body with a central spot of dull grey.

The larva of *A. argyrospila* is so similar to the above description that it is not necessary to draw attention to its characters.

Peronea (*Acleris*) *maximana* has proved an interesting insect attacking orchard trees in the Okanagan valley, not so much from its economic importance, which is slight, but from its identity and discovery. The early



Hypothetical Setal Map, after Fracker.

authors on British Columbia insects record the presence in the province of *Teras minuta*. Much of the work ascribed to the Bud Moth (*T. ocellana*) and to the Lesser Apple Worm has been placed to the credit of *Teras minuta* in the minds of field inspectors. Its presence is popularly believed to exist and doubtless some moths were originally identified as referable to this species. The writer has, however, been unsuccessful in recovering *Teras minuta* and all efforts to collect it or its near relatives have failed until this year when *Peronea maximana* was bred from the North Okanagan. Its identity was proved by Dr. J. McDunnough, Dominion Entomological Branch, Ottawa. Larvae of *P. maximana* frequent the terminal leaf clusters on water sprouts of apple trees, skeletonising the leaves, and may be found feeding during spring and until mid-July. Pupation takes place in July in leaf clusters and moths appear in August and September.

Larval characters. *Peronea maximana.*

The full grown larva measures 14 mm. in length and is of a uniformly pale yellow colour, tinged with green with a semi-transparent integument through which may be seen a broad bluish-black longitudinal stripe. The body segmentation is well defined with no readily observed markings of any kind. The ventral surface is throughout paler than the dorsal. Head pale yellow, shiny, with mouth parts of a decidedly purplish tinge. Tubercles inconspicuous, bearing short hairs of a pale colour.

Peronea agrees with *Cacoecia*, *Olethreutes* and *Enarmonia* in having mu, kappa and eta on the same pinaculum on the 9th abdominal segment but differs from all these genera in having the pi group of the 7th abdominal segment bisetose and the 8th segment unisetose. The pupa measures 12 mm. in length and is of an uniformly dark brown colour.

Olethreutes consanquinana while also known to occur in British Columbia on apple trees is not dealt with in detail in this paper owing to lack of material for study.

The Lesser Apple Worm, *Enarmonia prunivora*, must be considered next. This species of all others is most often confused with the Codling Moth. It is mentioned at this point for the reason that structurally it is more closely allied to *Acleris* (*Peronea*). *Archips* (*Cacoecia*) and *Olethreutes* than with the Codling Moth. With these genera it agrees in having alpha on abdominal segment 9 as distant from rho as from beta and never situated on the same pinaculum with rho. The association of mu, kappa, and eta on the same segment is also a guiding characteristic. None of these characters are found in Codling Moth larvae.

Larval characters. *Enarmonia prunivora.*

The full grown larva measures approximately three-eighths of an inch in length. In general colour the larvae vary from a white to a flesh pink but the pink shade is more pronounced than with the Codling Moth larva. The outlines of the body taper somewhat towards the extremities. The head, prothoracic shield and anal plate are dull brown. The plate upon the last segment of the body bears a few long hairs and immediately beneath its hinder margin is a peculiar pale brown comb-like structure, furnished with a series of acutely pointed teeth which lie parallel to each other.

The only other two larvae that need consideration are the Bud Moth, *Tmetocera ocellana*, and the Codling Moth, *Cydia pomonella*.

Both differ from other larvae mentioned and agree with each other in having alpha on abdominal segment 9 close to rho and on the same pinaculum with it, not associated with beta. The two larvae, however, are so readily distinguished from their colours and habits that there can be no confusion. The Bud Moth seldom penetrates to a greater depth in an apple than 2-3 mm. and is only fruit-infesting in the autumn and at a time when the larva does not exceed 5 mm. in length. The Codling Moth on the other hand, enters the apple as a minute larva and penetrates to the core at once, becoming full grown (¾ inch) in the fruit.

Larval characters, *Tmetocera ocellana.*

Larva full grown measures half an inch in length and is of a cinnamon brown colour with head, prothoracic shield and anal plate almost black. Kappa and eta on the first abdominal segment in a nearly vertical line.

Larval characters, *Cydia pomonella.*

Larva when full grown averages three-quarters of an inch in length, cylindrical or evenly rounded throughout, of a colour that varies from white to a pale flesh pink. Head brown with darker markings. Prothoracic shield and anal plate pale brown. Tubercles less distinct than in immature larvae. Alpha on segment 9 close to rho, and according to Fracker, usually situated on the same pinaculum with it, not associated with beta.

Thanks are due to Dr. J. McDunnough, Entomological Branch, Ottawa, for his kindness in determining *Peronea maximana, Cacoecia rosaceana, Epicallima dimidiella, Mineola tricolorella* and *Rachela bruceata. Marmara pomonella* was identified by Mr. A. L. Quaintance of the U. S. Bureau of Entomology and *Olethreutes consanquinana* by Mr. Arthur Gibson, Dominion Entomologist, Ottawa. Mr. E. P. Venables, Field officer, Vernon, B.C. has been associated with the author in this work and several of the records in this paper are due to field collections made by him.

For the sake of convenience I append an illustration adapted from Fracker's Monograph showing the twelve hypothetical setae with the three subprimaries.

VACANCIES IN THE INDIAN AGRICULTURAL SERVICE.

We have received announcement of several vacancies, open for application, in the agricultural service of India, as follows: 3 Deputy Directors of Agriculture, 7 Economic Botanists, 1 Soil Physicist, 1 Bacteriologist, 1 Agrostologist, 1 Professor of Horticulture, 1 Mycologist, 2 Professors of Agriculture, 1 Assistant Principal, Agricultural College.

In practically all cases, an applicant possessing a University degree is given preference. In research and teaching posts, two years research work is also preferable.

Any who are interested in further particulars regarding this service, should communicate with the Secretary of the Government of India, Department of Revenue and Agriculture, Delhi, who will furnish all information in regard to present vacancies, qualifications required, salaries, etc.

The vacancies mentioned above are as of January 15, 1921.

Control of Feeding Stuffs

Synopsis of Address Given by Mr. Geo. H. Clark, Seed Commissioner, before the Eastern Ontario Branch of the Canadian Society of Technical Agriculturists, February 18, 1921.

The Commercial Feeding Stuffs Act, 1909, required a statement of chemical analysis, guaranteed by the manufacturer, to be printed on the sacks or other receptacles which contained the feed. A sample of the material of which each feeding stuff was composed was filed confidentially in the office of the department administering the Act, lately the Department of Health.

For several years samples of feeding stuffs have been examined in our seed laboratories and reported upon to farmers in respect of their content of noxious weed seeds. Numerous communications received from farmers indicated that it was their primary desire to obtain information as to the ingredients of which the feeding stuff was composed in order to protect the health of their live stock. They had learned from experience that although some feeding stuffs were rich in protein and fat, and low in fibre, they were nevertheless injurious to the health of live stock.

To meet their needs we provided a service of qualitative analyses of ground feeding stuffs by process of vegetable microscopy, which in part led to strong demands from live stock organizations for more comprehensive regulation of the trade in feeding stuffs.

The Feeding Stuffs Act, 1920, provides that commercial feeding stuffs shall be labelled with the specific name of every ingredient contained in the feed as well as the analysis as guaranteed by the manufacturer. In addition special regulations are provided for chop feeds and for bran and shorts or middlings. Further, any material that is designated by regulation of the Minister of Agriculture as injurious to the health of live stock, is placed under severe restriction. The specific names of ingredients of feeding stuffs have been standardized by regulations recommended by an advisory board under the Feeding Stuffs Act.

Under this new act, before any manufacturer may legally sell any commercial feeding stuff in Canada he must have it registered, and with his registration he must state precisely, using the standardized names of ingredients, the material of which the commercial feeding stuff is composed and also the percentage of protein, fat and fibre as guaranteed.

These standarized names of ingredients of feeding stuffs appeared to be somewhat of a disturbing factor to many of the manufacturers. Manufacturers of oatmeal had seldom if ever sold oat hulls as such. Bran and shorts mixed with ground screenings had proven to be highly troublesome to feeders who had paid for bran or shorts. Gluten meal was the name commonly used for a product of starch factories composed of corn gluten meal mixed with all of the other by-products of the mill. A great deal of the meat meal sold in the trade was in fact ground cracklings or tankage.

Systems and regulations for the control of feeding stuffs are applied in most countries. Several of the states to the south have excellent feed laws and are well equipped for administering them. In consequence the dregs of the trade that are forbidden from sale in those states commonly find a market in other states or countries where the regulations are less exacting or are not efficiently administered. A survey of the situation in Canada would seem to indicate that we have been one of the few remaining dumping grounds for inferior and objectionable by-products of the packing houses, distilleries, linseed and cottonseed oil plants, and the industries employed in the manufacture of peanut, rice and fish products.

The efficient administration of our new Feeding Stuffs Act may be expected gradually to correct this disadvantage to the Canadian live stock industry. It will be necessary for those charged with the enforcement of this Act to acquire a good working knowledge of the grain trade, the milling industry, starch factories, oil mills, cereal plants, packing houses, sugar refineries and even of peat bogs, from which feeding stuffs are placed on the market in Canada.

We are now in process of developing six inspection districts. The three maritime provinces, for instance, are included in district No. 1. We hope ultimately to have each inspection district supported by a service laboratory that will handle all of the analytical work for the district. As yet we have only three service laboratories, our laboratory at Ottawa being now congested with seed analyses. Consequently we have had to issue instructions to our inspectors that we will not be able to handle many samples of feeding stuffs for them until after the middle of April.

For the present we obtain a service of chemistry from the laboratory of the Department of Health. Inspectors are instructed to give attention to the plants where feeding stuffs are manufactured, and to draw their samples of the material before it enters the grinder, because after it is ground it is not possible to make a quantitative analysis as to percentage by weight of each ingredient.

The milling industry yields by far the largest output of feeding stuffs sold in the Canadian market. Samples sent in by inspectors indicated wide variability, as between different mills, in the nature of the product that was sold under the name of bran, shorts or middlings. A conference was held on February 4th between three live stock representatives on the Advisory Board under the Feeding Stuffs Act, and three representatives from the Canadian National Millers' Association. This conference was not productive of conclusive results and was adjourned to February 10th.

The chemical standards for bran were 14 per cent. protein 3 per cent. fat and not more than 10 per cent. fibre. There are numerous small mills throughout the country which are still operating under the old "short process" of milling and which yield a bran that will conform to this old chemical standard. It was estimated, however, that fully 85 per cent. of the Canadian milling capacity was now operating under the newer "long process" of milling, which process extracts practically all of the flour out of the bran and shorts, thus leaving a bran containing 16 per cent. of protein, 4 per cent. of fat and 12 per cent. of fibre, but in which the carbohydrate is much reduced.

Practically all of the large mills have been grinding their mill run of screenings and mixing them with the bran and shorts before the bran and shorts have been separated by screening. As a result of the conference with millers they have agreed to keep their bran pure, to manufacture a product suitable for the feeding of young pigs and calves by blending what is known as

Red Dog flour with sufficient of the finer shorts to lighten it up and make a more suitable feed, and to market it in the pure condition quite free from ground screenings.

In the larger mills operated under the long process of milling, there remains an intermediate product which is composed largely of fine particles of bran and which they have been selling under the name of shorts. With this intermediate product they will include their mill run ground screenings and sell it registered as a commercial feeding stuff under guaranteed analysis.

The mills in eastern Canada obtaining wheat from the large terminal elevators at the head of the lakes will have shorts which contain about 12 per cent of ground screenings. The flour mills in western Canada which obtain their wheat before it is cleaned in the terminal elevators will have shorts that may contain as much as 25 per cent. of ground screenings. The brand name under which this product must be sold is prescribed in the act to be "shorts with screenings." About one third of the feeding stuffs by-products of the Canadian flour mills will be absorbed in the manufacture of this commercial feeding stuff. The other two-thirds will be sold as pure bran and pure flour middlings.

This arrangement seems to be satisfactory alike to the live stock feeders and to millers. Type samples of these products will now be supplied to each of the eight hundred Canadian mills and to our inspectors, and we are expecting that within another two months all Canadian mills will be working to these standards in respect of their by-products.

The screenings problem is an important one to Canadian agriculture and the live stock industry. The dockage set by grain inspectors amounts in some years to an aggregate of 150,000 tons. If properly handled about 48 per cent. of this material is of excellent feeding value. The balance has no actual known value for feeding purposes.

There is now established an optional standard of prescribed quality for Standard Recleaned Screenings. Any purchaser who specifies in his order "Standard Recleaned Screenings" will receive with his delivery documents a certificate from a grain inspector. If he does not specify "Standard Recleaned Screenings" in his order the grain inspector's certificate will simply indicate "Elevator Screenings."

Standard Recleaned Screenings are now selling at $14 per ton in car lots, bulk, f.o.b. Fort William. In point of nutrition, experiments have shown them to be equal to bran which is selling at $40 per ton.

This special grade of screenings, however, will not comply in its present condition with the provisions of the Feeding Stuffs Act and may not be sold for feeding purposes, but may be sold for the purpose of recleaning and blending by any manufacturer of feeding stuffs, including any farmer who operates a grain chopper and manufactures his own feeding stuffs. Standard Recleaned Screenings as a rule contain too large a percentage of mustard seeds to be sold as a feeding stuff without recleaning, and in that respect they are treated the same as the lower grades of feed oats, containing quite a large percentage of mustard seeds which are injurious to the health of live stock. Both feed oats and standard recleaned screenings are merchantable in the unground condition, but must have the mustard removed before they can be sold as a feeding stuff.

There would seem to be much need for a campaign of education among farmers, in regard to feeding stuffs and materials that are used in the manufacture of feeding stuffs. Probably few graduates of Canadian agricultural colleges would be able to differentiate, though they had the samples before them, between different grades of cottonseed or linseed products, or would be able to identify several of the various by-products which are now used as ingredients of feeding stuffs and which come from oil mills, fish canneries and the like.

A few years ago short courses in seed judging were highly popular throughout most of the provinces. We propose now to assemble and be prepared to distribute for educational work, fairly complete collections of the various kinds and grades of ingredients of feeding stuffs that are more or less common in our Canadian market.

Ignorance is said to be the environment in which fraud flourishes. We have had only six weeks of experience in the administration of the Feeding Stuffs Act and we have discovered much evidence of fraud, for which probably the environment is largely to blame.

SCIENCE AND AGRICULTURE.

Discoveries in Agriculture have been possible because the Department of Agriculture has had in its employ a body of trained workers, scientists of the highest order who devoted all their energies to serving the people. But the Department is now confronted with a very difficult situation in the matter of securing and retaining an adequate personnel. The research work of the experiment stations, like that of the Department of Agriculture, is fundamental. Unless there comes from these institutions a steady and abundant flow of new knowledge which can be utilized to meet pressing problems, agricultural advancement will slow down and our system of agricultural education, through colleges, schools, and the extension service will deteriorate . . . .

. . Agriculture is the greatest business and the most fundamentally important industry, not only because of the amount of capital invested, the number of people employed and the new wealth created annually, but because it supplies the nation's food, furnishes vast quantities of raw materials for the manufacture of clothing and other necessary commodities, and contributes largely to the export trade of the country.

(E. T. Meredith, Secy., U.S.
Dept. of Agriculture.)

The Agricultural College that has its feet upon the ground is studying agriculture as a national industry, and it is conducting a course of study whose backbone is intended to train men for operating farms and living in a country community. There are many departures from this central idea, both as to lines of study and subjects of instruction, as well as of occupational ends, but no one of these should be permitted to characterize the effort any more than a railroad siding should be permitted to function as a main track.

For example, production of food is an occupation, but farming is also a mode of life, and the farmer is not only a citizen of the state but its most nearly typical citizen. Wherefore, a distinct line should always run between the strictly technical, having to do with the business of farming, and the non-technical having to do primarily with the land. Both are necessary, but each in its own field because the man in a citizen sense is greater than his calling.

(Eugene Davenport, Dean of the
College of Agriculture, Illinois.)
(Extracted from "World Agriculture.")

The Immunization of Plants

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The term immunization is used in this paper as meaning the changing of the nature of an individual plant in such a way that it is no longer susceptible to a given pathogene. The application of the principle of immunization probably offers the ideal method of disease control but unfortunately our present knowledge of the best means of bringing about such a desirable condition is as yet rather unsatisfactory. In speaking of immunization in plants it is necessary for us to keep in mind that actual immunity very seldom exists in the plant world. What expresses nearer the truth and is now more commonly used is the term resistance. This latter term is used to express the ability of a plant to develop and function normally under conditions such that other plants of the same species would fail to develop or be destroyed.

The whole problem of the immunization of plants may be considered from two standpoints. First, artificial immunization obtained by introducing into the host certain chemical elements or compounds, and second, natural immunization by the isolation of resistant individuals by straight selection or by hybridization followed by selection.

Research on the first phase of this problem has been considerably stimulated by the success that has followed the use of anti toxins for the prevention of animal diseases. Many attempts to treat plants in a similar manner have been made, usually without due recognition of the totally different structure and mode of life of plants and animals. It is to be expected that due to the crudeness of the methods employed the majority of attempts to immunize plants by artificial means have failed. The problem, however, offers an interesting and profitable field of investigation.

Efforts to immunize plants by artificial means have been conducted along two definite lines, namely—soil applications and direct injection of serums, toxin and chemicals. The first named line of attack has consisted chiefly in the application to the soil of fertilizing elements or complete commercial fertilizers or the application of copper, iron or manganese sulfates. Laurent (1) in 1899 investigated the rotting of potatoes by bacteria not normally parasitic and found that their attack was either favored or hindered by the application of different fertilizers. Pinchi (2) claimed to have decreased the severity of the attacks of grape mildew by applying copper sulfate to the soil in close proximity to the attacked vines. Marchal (3) reports being able to produce distinct resistance to mildew, in lettuce, by the addition of copper sulfate to the nutrient solution in which the plants were grown. Massee (4) was able to immunize tomatoes against leaf mold, by watering them with a weak copper sulfate solution. Norton (5) in determining the effect of various chemicals in solution applied to the roots of tomato plants for the control of leaf diseases obtained on the whole negative results, although a few chemicals seemed to produce added powers of resistance in the plants when inoculated with the disease producing organism.

The method of direct injection of immunizing substances has been revived in late years. Bolley (6) has made use of both nutrients and poisons to control disease by injections of these substances into trees. Potter (7) used injections of a toxin from soft rot to exhibit the growth of the causal organism of this disease on turnips. Campbell (8) working in Italy claims that a wild scion grafted on a cultivated stock renders shoots from peach and apple stocks resistant to peach leaf curl and mildew respectively. Extraradicate introduction of weak solutions of tartaric, citric and malic acids rendered cultivated apples immune to mildew and to certain insects.

These few instances of reported success in artificial immunization are culled from a long list of experiments in which the results were largely negative.

Considerably more progress has been made in securing disease resistance in plants by natural means. This phase of investigation calls for the combined efforts of the plant pathologist and plant breeder. The plant pathologist must search the ranks of our different species for individuals that show more resistance than their fellows to a given pathogene. That plants of a given variety and similar in external appearances differ in their ability to resist the attacks of various pathogenes is now common knowledge. Of even more importance from a practical standpoint is the fact that these variations in degree of resistance are, in most cases, definitely inherited. Plants possessing resistance to any particular pathogene can therefore be used as a starting point for the production of resistant strains.

Figure 1. Two varieties of the white pea bean varying in their resistance to bean mosaic. Row A is badly attacked by mosaic, and in consequence only a very few pods have set. Row B. is resistant to this disease and has an excellent set of pods. Row A. would only yield from two to three bushels per acre, while Row B would yield from twenty to twenty-five bushels per acre.

Because of the fact that the isolation of individuals already resistant offers the easiest and least complicated method of obtaining resistant varieties or strains, it is to be expected that the majority of such varieties or strains now in existence should have originated in this manner. This accounts also for the fact that a few of our disease resistant strains have little else to recommend them. If what we desire in this connection already exists it is obviously unnecessary to seek any farther. However, it often happens that a disease resistant plant may be undesirable in other respects either because of undesirable growth characteristics or a very limited adaptability. Under such conditions it becomes necessary for the plant breeder to make use of hybridization with other types possessing the desired qualifications but lacking in their ability to resist the pathogene in question.

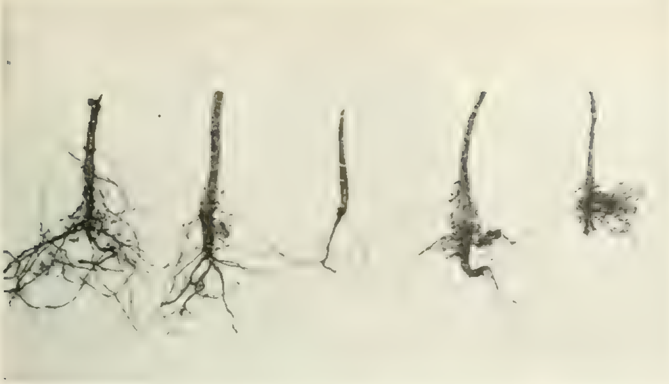

Figure 2. The condition of the roots of four varieties of beans differing in their resistance to the dry rot organism.

The process of producing disease resistant types by hybridization is necessarily slow because of the length of time that is required to isolate and fix the desired type from the miscellaneous population that will appear as the result of crossing. This diversity of the resulting population, while it constitutes a hindrance to rapid progress, is one of the factors in favor of the hybridization method of plant improvement in that the diverse population obtained affords a good opportunity of isolating a plant possessing the maximum of desirable qualities.

A few examples will suffice to illustrate the work that is being done, mainly by our plant pathologists, in the production of resistant strains by the isolation of resistant individuals from commercial varieties. Blinn (9) by selection within commercial varieties was able to isolate a cantaloupe resistant to rust. Hansen (10) has secured by selection a type of sand cherry resistant to mildew. Shamel and Cobey (11) obtained a strain of tobacco resistant to wilt by one year's selection. Bain et al. (12) selected a strain of Red Clover apparently resistant to anthracnose. Norton (13) found that the tomato varieties Stone and Stirling Castle possessed considerable resistance to the causal organism of leaf mold. Jones (14) developed a strain of cabbage possessing resistance to yellows. Barrus (15) reports a strain of beans, obtained by a grower from an individual plant selection, which is resistant to both strains of the bean anthracnose fungus.

The possibilities of the slower and more difficult method of securing disease resistant plants by means of hybridization, will be dealt with somewhat more fully. In this connection the work done in securing beans resistant to the causal organism of bean anthracnose will be used to illustrate both the possibilities and the difficulties of this method of immunization of plants. A few illustrations from work done along this line with other crops will be included for purpose of comparison and of more fully demonstrating the possibilities of this phase of investigation. Biffen (16) and Nilsson-Ehle (17) were each able to secure a number of hybrid wheats resistant to yellow rust from the segregates of crosses between resistant wheats and those susceptible to this disease. Orton (18) obtained the wilt resistant watermelon Conqueror by crossing the citron and watermelon. Tisdale (19) was able to secure a hybrid strain of flax resistant to flax wilt by crosses between resistant and susceptible varieties.

In the case of bean anthracnose two strains of the causal organism have been isolated by Barrus, (20) and the resistance and susceptibility to these strains of a large number of bean varieties demonstrated. For purposes of discussion the strains will be alluded to as Strain A. and Strain B. Unfortunately very few of our common field or garden varieties of beans are resistant to both of these strains. A considerable number, particularly of our garden beans, are susceptible to both strains of the pathogene. The remaining varieties are either susceptible to Strain A. and resistant to Strain B. or vice versa. This condition of affairs has been both a detriment and an aid in the securing of resistant types. The fact of the existence of two strains of the causal organism has decreased the chances of securing by selection individuals resistant to both of these strains. This same fact was, however, an advantage in that it presented the possibility of hybridizing a desirable variety resistant to Strain A. with a desirable variety resistant to Strain B., and isolating from the offspring strains resistant to both of these strains. This latter possibility was of particular advantage in that the two types of field beans that were resistant to both Strain A. and Strain B. each possessed the disadvantage of being a late maturing variety. One of these varieties also had a colored seed and was in addition very susceptible to bacterial blight.

A type of White Marrow bean resistant to Strain A. was crossed with a white pea bean type resistant to Strain B. The first generation plants of this cross were resistant to both strains of the fungus and the second generation, when inoculated with a mixture of both strains of the fungus, gave resistant and susceptible plants in the proportion of nine resistant to seven susceptible. One ninth of these resistant plants bred true for this character. The remaining eight-ninths when

Figure 3. Four varieties of beans that have been inoculated with strain A. of the bean anthracnose fungus.

Figure 4. The same four varieties (see Fig. 3) inoculated with strain B. of the bean anthracnose fungus. It is evident that variety No. 1 is resistant to both strains, variety No. 2 resistant to the A. strain but susceptible to the B. strain, variety No. 4 susceptible to the A. strain but resistant to the B. strain, while variety No. 5 is susceptible to both strains of the fungus.

grown to the third generation and re-inoculated gave a proportion of plants that continued to breed true for resistance to both strains in subsequent generations. Of the susceptible class three-sevenths were resistant to Strain A. but susceptible to Strain B., three sevenths resistant to Strain B. but susceptible to Strain A and the remaining one-seventh susceptible to both strains of the causal organism. Thus we see that by crossing the two varieties of beans mentioned it was possible to isolate not only strains resistant to, but also strains susceptible to, both strains of the anthracnose fungus, without resource to either a homozygous resistant or a homozygous susceptible variety.

The enormous losses entailed annually from diseases apparently beyond our control by artificial means as well as the labor and expense of our sprayings and seed treatments, point to the necessity of furthering as rapidly as possible natural means of control. Each year we patiently submit to losses from various diseases of our cereal and horticultural crops when such losses could be prevented by intelligent breeding of resistant varieties.

The need of the hour, then, is the closer co-operation between the plant pathologists and the plant breeders of the country, investigators with special training in pathological plant breeding, and finally sufficient moral and financial support to carry this work forward to a successful termination.

Literature.

(1) *Ann. de l'Inst. Pasteur, Vol.* 13, 1899.
(2) *Nuov. Giorn. Bot. Ital* 23: 361. 1891.
(3) *Compt. Rend.* 135; 1067. 1902.
(4) *Jour. Roy. Hort. Soc.* 28: 142. 1903.
(5) *Md. Agr. Expt. Stn. Bull.* 192. 1916.
(6) *N. Dak. Expt. Stn. Ann. Rept.* 13, 1903, *and* 14, 1904.
(7) *Jour. Agr. Science.* 3: 102. 1908.
(8) *Abst. in Internat. Rev. Sci. Pract. Agr.* 9: 674-675. 1918.
(9) *Col. Agr. Expt. Stn. Bul.* 104. 1905.
(10) *A.B.A. Rept.* 1: 190-191. 1905.
(11) *U. S. Plant Ind. Bul.* 86; 7-67. 1907.
(12) *A.B.A. Rept.* 3: 190-195. 1907.
(13) *Phytopath.* 4: 398. 1914.
(14) *Wis. Agr. Expt. Stn. Res. Bul.* 38, 1915.
(15) *Phytopath.* 5: 303-311. 1915.
(16) *Jour. Agr. Sci.* 1: 40-44. 1905.
(17) *Lund's Universitets Arsskrift N.P. Afd.* 2. 7: 57-82. 1911.
(18) *Science* 25: 388-389. 1907.
(19) *Jour. Agr. Res.* 11: 373-606. 1917.
(20) *Phytopath* 8: 12. 589-614. 1918.

ANNUAL MEETING OF THE QUEBEC SOCIETY FOR THE PROTECTION OF PLANTS.

The thirteenth annual meeting of the above Society was held at Macdonald College on March 1st, 1921, and the members were cordially welcomed by the Principal, Dr. F. C. Harrison. There was a good attendance of members and associates and keen interest was evinced in the papers presented. In addition to papers by regular members, three addresses were given by visitors as follows:—

Prof. H. H. Whetzel, head of the Department of Plant Pathology at Cornell University, on "The Present Status of Plant Pathology in Agriculture;"

Dr. W. T. MacClement, head of the Department of Botany at Queen's University, on "Our Bird Allies."

Mr. A. Gibson, Dominion Entomologist, on "The Work of the Entomological Branch."

Professor Whetzel instanced the great strides made in New York State towards efficient and hearty co-operation between farmers, fruit growers, etc., and the staffs of Agricultural Colleges. He pointed out that the tendency is to demand trained men in Plant Pathology in every agricultural centre, just as doctors of human ills and veterinarians are required in every centre. The time will come when the Plant Pathologist will "hang out his shingle" and be successful.

Dr. MacClement gave a splendid address, well-illustrated, on those birds useful and harmful to agriculture. Charts showing the food content of young and adult birds gave force to his arguments that useful birds should be protected and encouraged.

Mr. Gibson illustrated his address by slides of the laboratories and insectaries in different centres where the Entomolgical Branch has stations.

The papers by Mr. Kelsall on the "Chemistry of Sprays" and by Mr. Petch on "Spraying versus Dusting" were excellent and gave rise to considerable discussion. Kelsall showed exactly what reactions take place, and under what conditions, when sprays are used. Moisture and excretions from the fungus itself play a most important part in making a fungicide efficient. The questions of leaf injury and the use of calcium arsenate were dealt with in detail.

Mr. Petch finds that dusting is on the whole better, more easily carried out, and is becoming cheaper than spraying. This view was generally held to be true by the meeting, the only point of difficulty being the control of Black Rot in the orchard.

Prof. Lochhead, in his Presidential Address, discussed the "Story of Sprays" and a copy of his paper appears in the present issue.

Mr. L. S. McLaine presented an illustrated paper on "The Discovery of the European Corn Borer in Southern Ontario," discussing the area involved, the methods of disinfection and quarantine.

Dr. G. P. McRostie took up the question of plant breeding for immunity and a copy of his paper also appears in the present issue of "Scientific Agriculture."

Mr. Hockey was unfortunately ill in hospital, but his paper was read by Prof. Dickson. There is no reference in literature to the germination of the teliospores of Puccinia Antirrhini causting rust of Snapdragon, but Mr. Hockey was able to get as high as 22 per cent. germination and sporidia developed on the promycelia. No infection occurred on the Snapdragon by sporidia, so that if there is an aerial stage, it probably occurs on an alternate host.

The French members presented a series of papers as follows:—

"Protective Seed Treatment", by Mr. G. Maheux, Provincial Entomologist for Quebec.

"Protective Treatment of Woods used on the Farm" by Mr. A. Roy, of the Forest Service.

"Observation on the Potato Plant Louse," by Mr. O. Caron, Assistant Entomologist, Quebec.

"The Larch Aphis," by Dr. J. C. Chapais, and

"Care of Shade Trees on the Farm," by Mr. J. E. Gravel, Forest Service, Quebec.

Reports of delegates to the Ontario Entomological Society and the Canadian Branch of the Phytopathological Society were given.

The officers for the ensuing year are as follows:

President, Prof. W. Lochhead, Professor of Zoology and Entomology, Macdonald College.

Vice-President, Rev. Fr. Leopold, Director, Oka Agricultural College.

Secretary-Treasurer, Prof. B. T. Dickson, Professor of Botany, Macdonald College.

Some Objectives

L. S. KLINCK, President of the Canadian Society of Technical Agriculturists.

The objects of the Canadian Society of Technical Agriculturists, as set forth in the Constitution which was adopted at the Ottawa Convention last June, are deserving of the most careful study on the part of every member of the organization. To these objects, the Organizing Committee had given long and exhaustive study. The fullest expression of opinion had then been sought from leaders in agricultural thought in all parts of Canada, and their suggestions had been embodied in the second draft. As a result of this preliminary work the Committee on Constitution had, as a basis for their report, the mature judgment of a wide and representative constituency. To this body of considered opinion, the Committee on Constitution devoted their best thought; and the results of their deliberations were, in turn, still further perfected as the outcome of the discussion on the floor of the Convention when the Committee's report was received and considered clause by clause. The objects of the Society therefore, as embodied in the Constitution, may safely be taken as representing the composite judgment of the membership.

These objects, as set forth in Article two of the Constitution, are not all of equal importance. In the nature of the case it could not be otherwise. Some are of primary importance; others are clearly secondary. Some are comprehensive and far-reaching; others are comparatively restricted in their scope. Some are capable of realization in the immediate future; others call for years, possibly decades, for their accomplishment. Some are largely dependent for their attainment upon executive foresight and initiative; others can be brought to full fruition only as the result of sustained interest and aggressive action on the part of the great body of the membership. Some relate themselves to members of the Society only; others—and happily by far the larger number—have to do with the raising of the standard of the service to be rendered to the farming community and to the agricultural industry as a whole.

It would not be reasonable to assume that all members would be agreed as to the order of importance of the objects specified. Upon this point it is not necessary, and perhaps not even desirable, that unanimity of opinion should obtain; and yet it is not without significance that the maintenance of high standards in the profession should have been the first object set forth, after the basic need—that of organization—had been recognized and met.

With all due respect to what graduates of our agricultural colleges in Canada have achieved in the past, and with a full realization of the valuable contribution they are making today to the promotion of scientific and practical agriculture, no delegate could but be impressed with the remarks of the many speakers who emphasized the necessity for higher academic standards for undergraduates, and for larger opportunities and better facilities for postgraduate courses. One speaker, who has had long experience as an administrator in one of the important departments of the public service which has on its staff large numbers of graduates in agriculture, was frank enough to say: "We have been looked upon by many of the University associations and many of the University graduates as being men on a lower level in investigatory character than they are themselves and we cannot expect them to change their minds in this respect unless we assert ourselves and demonstrate to the world that we have just as high scientific and investigatory powers as they have."

While it does not follow that this opinion, which is sometimes expressed by the alumni of other faculties, sustains any relation to the facts in the case, it does reveal very clearly a point of view, an attitude of mind, which we, as agricultural graduates, would do well not to ignore or lightly to dismiss.

Agricultural colleges, like other institutions of learning, are slow to undertake educational experiments. Marked departures from the accepted practices are generally left to new institutions. The past few years have, however, seen a number of agricultural colleges inaugurate some important educational experiments which, judging by their success under other conditions, give promise of marking another milestone in the progress of agricultural education. The plan of these newer educational experiments has greater pedagogic consistency than the old, and has been evolved largely as the result of a careful re-examination of the curricula of the different colleges, with a view to providing a thorough training for men who aim to qualify themselves for positions requiring the highest degree of professional knowledge and technical skill.

This is as it should be. No other subject was so frequently referred to by delegates to the Convention as this. Speakers did not allude to it because they were pessimistic, as some at first assumed, but rather because they saw clearly the pressing need for the extension and enrichment of the present curricula. No single feature of the Dominion-wide gathering was more encouraging or was fraught with greater possibilities for progress than this. In their attitude towards this question, technical agriculturists showed that, as a professional body, they were prepared to meet the issues squarely, to voice their convictions courageously and unitedly to bend their energies to the accomplishment of this fundamental task.

The aims and interests of agriculture and of the technical workers engaged therein, can no longer be best served by individuals working singly or in small, isolated groups. The issues involved have become too large and the ramifications too numerous and far-reaching for individual action to be effective. The decision of the technical agriculturists, as a body, to exert their influence in the direction of higher standards of college work, of closer co-operation among workers, and of better coordination in experimentation and research, without respect to the auspices under which the investigations are being conducted, augurs well for the future of the profession and of the industry.

The European Corn Borer

H. G. CRAWFORD,
Entomologist, Division of Field Crop and Garden Insects, Entomological Branch, Department of Agriculture, Ottawa.

An address before the Lambton County Corn Growers Association at Petrolia, Ontario, February 10, 1921.

Up to the present time the corn-growers of Canada have been particularly fortunate in the freedom of their crop from serious or regular losses due to insect pests. True, we have suffered from cutworms, white grubs, wire-worms, and a few others but only sporadically and rarely seriously from year to year.

Today, on the other hand within a fairly large part of Ontario where corn is grown as an important grain crop this happy day is past. We have been rudely awakened to the realization of the fact that there is in our midst an insect pest of great importance. An European insect has invaded our corn-growing region and has become established to such an extent and under such conditions that it is difficult to see how it can be exterminated. It, therefore, may eventually spread over most of the continent, exacting an annual toll of incalculable amount and bidding fair, if our fears are not entirely misplaced and if vigorous control measures are not instituted, in the meantime to further disorganize the whole corn-growing industry. What this means when we realize that the corn crop of the county of Lambton is valued at $1,679,000, that of Ontario at $36,000,000, while that of the continent is worth annually approximately $3,000,000,000, I need not enlarge upon to corn-growers.

The insect pest referred to is the European Corn-borer, *Pyrausta nubilalis* Hbn. The discovery of the presence of this insect in the late summer of 1920 over a large area of the corn-growing region of Ontario certainly came as a most unwelcome surprise to the entomologists and agriculturists of Canada.

The present status of the Corn-borer in the United States, where it was discovered in Massachusetts in 1917, may be briefly sketched by saying that there are three infested areas—one in New England, Boston City and neighboring counties of 3350 square miles, one in Central New York of 1365 square miles and one in Western New York of 936 square miles.

In the New York infestations the actual damage is not great and the infestation is chiefly in field corn, and to some extent in weeds. The intensity of the attack, however, is in no way comparable to that of our own in the St. Thomas region.

The New England infestation, though, in sweet corn, shows what we may expect of this pest under favourable circumstances. Here 100 p.c. of the corn may be attacked, single corn plants containing as high as 117 larvae; an average of 46 larvae per stalk in one patch was secured. One hundred and sixty of the commoner weeds are readily utilized as food plants and numbers of fields and truck gardens not in crop have 100 p.c. of the weeds infested. In each of these weeds may be found from one to at least ten larvae.

In addition most of the succulent stemmed truck crops are infested to a greater or less extent, such as celery, beets, potatoes, dahlia, chrysanthemum, etc. This variety of host food plant together with the fact that in New England the borer has two generations, produce an abundance of borers, impossible to realize from description and astounding to see.

The presence of the larvae in the stems of the truck crops which are shipped widely from the Boston area, (75 p.c. of the celery used in the New England States is grown within the limits of greater Boston) necessitated a very rigid quarantine, inspection and certification system to prevent general distribution of so serious a pest.

The efforts to control the borer in the United States were prompt and involved the first year, 1918-19, the voting of $100,000 by each of the states of Massachusetts and New York, and in the following year of $250,000 by the federal authorities, while last year in addition to a regular appropriation of $250,000, $450,000 was set aside for this work by the Federal department of Agriculture. The last report of the chief of the Bureau of Entomology which is for the year ending June 10, 1920, states that there are 194 men engaged directly in the control of this pest. Since this report was published the staff has been considerably augmented, at least some 30 men being engaged in investigation alone and 75 inspectors concerned with the enforcement of the quarantine.

Ever since the discovery in the United States of the borer the Entomological Branch has been aware of the danger of the importation of this pest into Canada and as a consequence has taken every reasonable step both to determine its presence or to prevent its importation. To this effect the border counties and corn-growing sections in particular were circularized in post offices and railway stations and through agricultural officials, by means of illustrated posters as soon as possible after the presence of the pest in the United States was known. These placards described the insect, its damage, warned the public against the danger of importation, requesting at the same time that anyone finding a borer in corn should send the same to the Dominion Entomologist, Department of Agriculture, Ottawa, so that it might be identified. In this way by enlisting the cooperation of that part of the community interested and likely to meet the pest first, its presence would be noted at the earliest opportunity, and we should be able to nip the infestation in the bud did it actually occur. At the same time a rigid inspection of the importation of corn and corn products as well as plants and materials likely to harbor the pest was established at the border.

As part of this protective and preventive system the best of the experienced scouts and field men formerly engaged in the Brown-tail moth work of the Entomological Branch were sent to the infested areas in New York State in order to have first hand knowledge of the appearance of the infestation and to study the best

methods of scouting to determine its presence in a district. These men upon their return in November, 1919, were immediately put into the field in Welland county to scout the district in closest proximity to the nearest United States infestation and to act as an assurance that we did not have the pest in the area most liable to attack. The snow came early and the men got into the field late. Though a preliminary scouting was attempted it was under the most adverse conditions and no borers were found.

Meanwhile no reports of its presence reached the Entomological Branch from the corn growers as might have been expected from the posters and general information given out, had the insect become established and had it been causing any damage. Thus the Branch felt that as yet in all probability we had escaped. The following year, 1920, continuing the educational policy, illustrated posters were again distributed in the districts most likely to be affected and as in the former year were exhibited in the more conspicuous and frequented of public places. Notwithstanding the further distribution of such warning posters and to make doubly sure, a scouting party was sent into Welland county in the latter part of the summer and to our consternation the scouts had not been in the country for more than three days when borers from corn were sent to the Branch at Otawa and identified as the European Corn Borer.

Map of western Ontario showing area scouted for European Corn Borer in 1920. Townships in solid black were found to be infested, those crossed by the diagonal lines only were scouted but no borers were found.

The scouting activities were immediately reorganized in cooperation with Professor L. Caesar, Provincial Entomologist, of the Ontario Department of Agriculture. Two parties were formed, the members of which scouted in the 13 counties most likely to be infested. Of the 105 townships in which scouting was done 35 were infested.

The townships in which the corn borer was present comprise two separated invasions, areas of different sizes and intensity of infestation, the smaller one made up of the 5 townships of Wainfleet, Humberstone, Bertie, Moulton, and Sherbrook in the counties of Welland and Haldimand, an area of about 340 square miles, in which the infestation is very light and the damage slight; a larger one consisting of the 29 townships of Dereham, Norwich north, Norwich south, Oxford north, Oxford west, Missouri east, Dorchester north, Westminster, Deleware, Caradoc, Missouri west, London, Biddulph, Lobo, Adelaide, Metcalfe, Ekfrid, Mosa, Bayham, Malahide, Yarmouth, Dorchester south, Southwold, Dunwich, Aldborough, Usborne, Zone, Oxford, Howard and Harwich in the counties of Oxford, Middlesex, Elgin, Huron and Kent, an area of about 3430 square miles. It is in this area in which corn is grown as a commercial crop and which is in immediate proximity to the still other important corn-growing counties, the balance of Kent, Essex and Lambton, that we have the most widespread infestation and in which it has attained its greatest intensity and is doing the greatest damage as a corn pest on this continent.

A study of the insect within this area shows that it is markedly at its worst in the essentially flint corn growing region immediately south of St. Thomas, being distinctly worst in the Union Village area. However, anywhere between St. Thomas and the lake tremely badly infested fields of flint corn are common. The region of worst attack is approximately an oval area about 7 miles north and south and about 10-15 miles east and west, the western edge being about 2 miles west of Union Village. From this centre of severe injury the intensity decreases rapidly westward, eastward and northward till it tapers out entirely in the marginal townships of the infested zone. However even as far north as Strathroy, spots in the flint corn fields are still found where a large number of the stalks have fallen down before harvest time. These were not studied and the infestation in these fields cannot be exactly stated.

The most important and immediate problem from the point of view of the grower and the one upon which to base the scope of our control effort was, of course, a determination of the probable damage to be expected from this insect. Hence the investigational activities during the autumn of 1920 took the form of studying as completely as possible to what extent the corn crop was actually being damaged and what the prospects of damage might be for the future. With this object in view the preliminary work was carried on in the centre of the most badly infested part of the large area, though not in the worst fields as it was afterwards discovered.

The degree of infestation here was much more intense in the flint corn than in dent and as a fairly complete study was made of the condition of the flint corn crop on the Hathaway Field near St. Thomas, all the figures presented on the chart (See Fig. 2) refer to the study in that particular field. The dent corn was much less severely affected than the flint and will be discussed separately after dealing with the former.

The injurious stage of this insect is a small greyish white caterpillar, when full grown about 1 inch long, which may be found boring in almost any part of the corn plant. The adult stage is a small pale yellow (female) or reddish brown (male) moth with a wing expanse of about 1⅛ inches which we suppose, from what is known of the life-history in New York, flies in Ontario in late June and July. It lays its eggs chiefly on the under side of the leaves of the corn plant and probably to a slight extent upon the neighboring weeds of which we have found 8 species infested.

These eggs are laid in small irregular, flat masses of

from 5 to 50, overlapping, fish-scale-like eggs. The eggs hatch into the larvae or caterpillars which alone are responsible for the damage.

The caterpillars or borers spend their lives in the corn stalks upon which they feed and within which they pass the winter. In the spring with the beginning of warm weather the borers begin to feed again and go through the changes preparatory to emergence as moths.

The habit of wintering in the stalks seems to be the easiest point of attack and hence later in the discussion we recommend low cutting of the plants, the ensiling of the corn and the destruction by burning or feeding of the crop refuse in field and barnyard.

The general field attack (See Fig. 2) on the flint corn in the Union Village region and extending as far north as Port Stanley runs from 70 p.c.—99 p.c. of plants attacked. In the field studied 93 p.c. of the corn stalks were infested and a few of the weeds. This attack upon the corn plant was general and involved any part above ground, the various parts of the stalks and ears in the field were infested in the following proportions: tassels 50 p.c., joints 17 p.c., interjoints 25 p.c., cob shanks 51 p.c., cobs 55 p.c., stubble 57 p.c.

The attack resulted in the following condition in the crop—51 p.c. of the tassels fell off and 42 p.c. of the corn stalks broke at one or more points of infestation (which may be at any height) and fell either completely or partially. This breaking of stalks not only adds to the difficulty of harvesting but also adds greatly to the crop refuse left in the field, involving a loss of feeding material and providing winter quarters for a large number of borers. In another field of mixed flint and dent corn the crop refuse alone was carrying 7245.0 borers per acre over the winter.

It was the attack upon the cob, however, which caused the greatest loss, 3 p.c. of the kernels being devoured

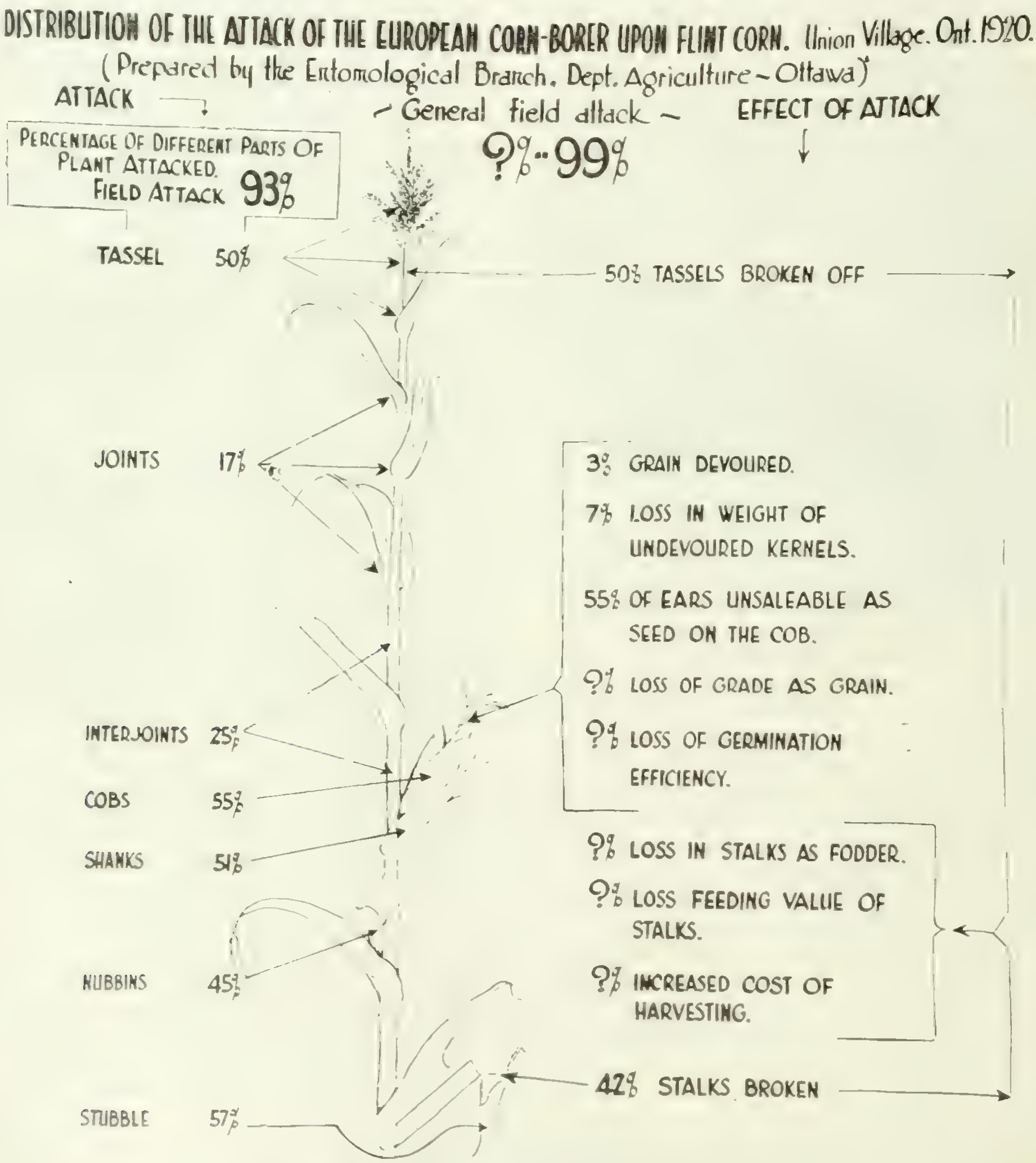

Fig. 2. Wall chart indicating distribution of infestation and consequent damage by the European Corn Borer in a flint corn field, Union Village, Ont., 1920.

and hence lost; the infested plants in addition showed a $7\frac{1}{2}$ p.c. decrease in weight of the non-infested kernels, 55 p.c. of the cobs were useless for sale as seed on the cob as no one is likely to buy seed corn on the cob, part of the kernels of which show insect attack. The other elements of loss, as yet not definitely estimated, include the undoubted and marked loss in commercial grade of the shelled corn due to the presence of the devoured grains and the light weight of the grain from infested stalks, the reduction in germination efficiency and the loss of feeding material in the stalks due to the increase of crop refuse. To this must be added as well the decrease in value of the infested stalks, arising both from material actually eaten by the borer, and the loss of substance due to interference with the plants' activities. Thus in the flint corn the total loss is very important and must interfere to almost a prohibiting degree with the market value of the crop. When it is realized that in this corn field there was only an average of 3 borers per stalk and that in Boston in certain corn fields the average was 46 per stalk and that in our field we have found as high as 16 in one stalk, it behooves us to be up and doing and to keep within the narrowest limits the ravages of this pest. We have as yet no warrant for thinking that this pest has attained in Ontario to anything like its possible degree of infestation or the possible damage it may cause.

The condition of dent corn in this vicinity was markedly different. Though the field infestation of a crop of dent about 400 yards from the flint field discussed above was 45 p.c., yet the loss was remarkably slight, only 7.7 p.c. of the tassels being broken and 8 p.c. of the stalks broken over. Practically none of the cobs were attacked and the grain loss, if any at all, would not be worth mentioning.

Even where dent and flint were grown mixed and the flint cobs were running 38 p.c. infested, the dent cobs of which there were but few, only showed an infestation of about 9 p.c. The dent stubble, likewise, seems to be a markedly less common place than that of flint stubble for spending the winter. This is shown not only in pure stands but in mixed stands as well.

However we should not put too great dependence upon this apparent preference for flint. When in the Boston region last fall we observed that the dents in the sample plots were very severely attacked and looked a wreck—as high as 25 borers being found in a single stalk; these, of course, being second generation larvae. Thus we have every reason to suppose where flint corn is not present in sufficient quantity to serve as a bait and more attractive food supply (as is the case of the district from west of St. Thomas to Essex County) and as the numbers of the borer increase, the dent corn will become more and more severely attacked.

This general increase of attack we should expect to be the most severe in the next few years. In course of time, however, parasites already preying on the borer to a very slight extent in the Boston infestation —will follow the borer as it spreads and eventually we hope hold it in check to such a degree that its ravages may be reduced to a point where careful routine farm practices will keep it from being a serious detriment to the corn industry.

The natural spread of these parasites will be assisted as fully as possible by the entomologists through artificial means, such as distributing to the infested areas such parasites as seem of value. At the present time the U. S. Bureau of Entomology has established a laboratory in Southern France for the collection and forwarding to America of parasites of particular value in Europe. The Dominion Entomological Branch has been assured by the U. S. Bureau of Entomology that when these shipments of parasites from France arrive in goodly numbers, consignments will be forwarded to the Canadian Government for the benefit of our own corn growers.

One of the most promising and valuable features of dealing with this pest has been the spirit of cooperation evidenced between the various entomological services, the agriculturists, and the press. As the matter is of vital importance to the United States, the province of Ontario, and the Dominion of Canada as a whole, this cooperation cannot but continue and be reflected in the effectiveness and speed with which this insect will be brought under control. To these forces we fully expect to add the hearty cooperation of the growers themselves; then will we have attained the almost perfect condition in which a maximum of result will be secured with a minimum of delay, loss and inconvenience.

What part can the growers play in this work? All can do their part in preventing the distribution of the borer by assisting whole heartedly in the maintenance of the quarantine and by impressing those who are less familiar with the dangerous possibilities of the pest, with its seriousness.

To those of us who are fortunate enough to live in the non-infested territory we recommend eternal vigilance: 1. Avoid corn on the cob from the infested areas and all such materials as are likely to carry the borers. 2. Watch your corn for broken tassels and borings in the stalks. Whenever these are noted advise the Dominion Entomologist, Department of Agriculture, Ottawa or the Provincial Entomologist, Guelph, of such findings.

To those who are in the infested areas and whose corn crop is infested with the borer either slightly or severely, and whether growing flint or dent corn, the following practices are advised:

1. Keep corn crop and fence rows clean of weeds, as these are food plants of the borer.

2. Cut dent corn crop as low as is possible with the corn binder. This will leave very few borers in the stubble.

3. Cut flint corn preferably at the surface of the ground by hand with hoes, or if a binder is used cut as low as is possible. The binder however, leaves quite a number of borers in the stubble.

4. Clean up crop refuse in all infested corn fields by hand rake or horse rake, even at some expense as this will contain thousands of borers per acre. This refuse should either be burned, fed or put in the silo; preferably burned or put in the silo.

5. Avoid above all things, allowing pigs to harvest the corn. They kill practically no borers and make it impossible to have a clean field.

6. Consider a silo from the point of view of combating the borer, the most important part of the farm equipment. The fermentation of the corn in the silo kills the borers. If all the corn will not go into the silo in the fall, put it in later after the ensilage has settled down.

7. If the silo is impossible and corn stalks have to be fed, either shred before feeding or see that the uneaten parts are set aside in a heap and burned in the spring before the thaw. Do not throw them into the bedding or loose manure pile. If they must be kept

for some reason, then compost with sufficient horse manure to ensure thorough heating.

In conclusion summarizing the situation, we have in the European Corn Borer an insect capable of inflicting great damage to the corn crop of Canada and which is already established in a large area and doing marked and measurable injury in parts of the area most heavily infested. It is likely to spread over the whole corn-growing districts, at least, unless very definite and prompt measures are taken for its control. Among these measures are the Federal Corn Quarantine, the vigorous investigations being carried on by officers of the Dominion Entomological Branch, the Provincial Department of Agriculture through the Provincial Entomologist at Guelph, and lastly the field practice by the growers based upon these investigations. This field practice involves as complete a destruction of the corn crop refuse as is practicable under farm conditions—low cutting, feeding the edible parts, and the complete destruction of the balance by burning before spring of the following year. It is only by this united front that rapid spread and serious annual loss from the pest can be avoided.

IMPORTANT NOTICE.—We are advised, too late for type correction, of the following changes in the foregoing article: (1) stubble infestation in the Hatheway flint corn on chart and in text, should read 29.18% instead of 57%. (2) loss in weight from grain not devoured, due to infestation of flint corn stalks, on chart and in text, should read 4½% instead of 7½.

The Mission of the Agricultural College

An address by President Reynolds at the O. A. C. Re-union. Toronto, March 10, 1921.

This is an exceedingly important occasion. It is important because it is the first provincial gathering of the Alumni and it is also important because it has been so seriously taken into account and has drawn together so many representative graduates and friends of the Ontario Agricultural College.

An agricultural college, it is not necessary to remark, is a vocational college, which means that those who enter its doors and have the benefit of instruction from the college are more or less, directly or indirectly, closely or remotely, connected with agriculture. I have made a rough survey of the occupations of the graduates from the first year when men were graduated from the institution, and while I find nearly all occupations represented from agriculture to theology, nevertheless most of these men are connected with agriculture. Some of them have a very distant and remote connection but one may define that connection variously, either that they are working farmers or that they are working the farmers. Some of the graduates of the college have found it more to their taste and liking to farm and some have found it more to their taste and liking to farm the farmers, but even those who are working the farmers are associated with agriculture.

The question might well be asked, since this is a toast to the Alma Mater, what this association may do for the college and for the purposes for which the college was instituted. I shall deal with that briefly because the answer is obvious. First of all, I think, you should keep up your interest in the college and its work, and the fact of your presence here tonight indicates that you are keeping up that interest. Secondly, you will agree that the Alumni of the college should direct and lead public opinion and public information respecting the work of the college, because it is very easy for one not connected with the college in any way to have quite wrong opinions concerning its purpose. For example, the commonly received opinion respecting the purpose of the college would condemn a good many of you in the occupations you are pursuing, in that you are not actively engaged in farming. That opinion ought to be corrected. The argument against that opinion is that the public work throughout the Dominion, in the Federal Department of Agriculture with all its branches, in the Provincial Departments of Agriculture with all their branches and in the work of the various agricultural colleges, has created a demand for a certain type of training which the colleges have set themselves to fulfil, and in this they have been entirely justified. The supply of trained men has to come forward in response to the demand and the institution is there to meet that demand.

I will deal for a few minutes with the question of the mission of the agricultural college and of its alumni in the various occupations that they may pursue. What is the mission of the college? You may not agree with me when I state the mission in these terms: the redemtion of Canadian agriculture from its disabilities and penalties. A large order you say, because we are pretty well aware that those disabilities and penalties are just those factors which have deterred so many of you from following actual farming, but if through the efforts of the O. A. C. and all of its Alumni, these disabilities and penalties can be removed, then agriculture will be elevated to a higher plane. The disabilities and penalties are sordidness and isolation, sordidness being largely, in my opinion, an intellectual quality and isolation being a physical and social quality.

However it has been accomplished, Canadian agriculture is not of the type of the European peasant agriculture. A short time ago a Belgian labor leader was speaking, and he is reported to have said, "The European farmer is a peasant, a small unit producer, who uses very little machinery, who produces nearly all that he needs and sells comparatively little from his farm, so that the farm is a self-contained unit. One result of this is the present condition of Europe: a thriving countryside and starving cities." We have in Canada a thriving country. There is, in small measure, unemployment and distress, but "Starving cities" does not describe the normal condition, and the reason is that agriculture has been redeemed from sordidness and isolation and has become industrialized and commercialized.

You may enjoy the hospitality of a typical Canadian farm house, inspect its premises and equipment, and you will find on the table, instead of the provisions being confined entirely or almost entirely to home products, that a considerable percentage of the food is purchased from very distant lands or from other parts of the country and is in a manufactured form. On the premises, with respect to the equipment, that farm is highly industrialized in that it is well furnished with machinery which has been purchased from the industries of the town. So that there is that remarkable difference between the European peasant type of farmer and the Canadian farmer; the Canadian farmer has ar-

rived as a conscious factor in world progress and world welfare. I consider that an immense accomplishment in agriculture. In the work that is carried on, the Canadian farmer uses the products of the cities and the output of Canadian commerce and industry. That being so, the chance that our cities will reach the condition of European cities is a very remote one. And that being true, I would call the attention of our legislators and of our leading men in the cities to the fact, pointing out the exceeding importance that everything possible and reasonable and practicable be done in Canada to foster the interests of agriculture.

The antagonism between town and country interests must be obliterated and forgotten, and town and country must work together towards the making of complete Canadian citizenship. That should be the ultimate condition of our body politic. Any movement or any line of thought, political, economical or social, which tends to maintain a cleavage between the interests of town and country, should be discouraged. It should be the aim of the Alumni of this college, knowing what the college is trying to accomplish and looking towards the redemption of our farmers from the sordidness and isolation of their occupation, to act as mediators between the jarring and clashing interests in this country.

I mean by sordidness the lack, where it exists, of any intellectual interest or occupation associated with farming, and if a college and its Alumni cannot appreciate and cannot promulgate that result of agricultural education, then it seems to me that the college must signally fail. That is one of the problems of the agricultural college which must be solved largely through its alumni, to point out that agriculture is an occupation requiring a high degree of trained intelligence which must be applied if agriculture is to be successful. And where it is applied agriculture is no longer sordid.

Granted that agriculture can be redeemed, in a measure at least, from these two disabilities, what then remains? My experience in agriculture is that those disabilities of sordidness and isolation removed, agriculture remains an interesting and desirable occupation. It presents to a degree which few occupations present, the qualities of freedom, both intellectual and physical, of variety and of continual interest. It is a common superstition that the work of agriculture is monotonous. I never found it so. Agriculture in the variety of its occupation is as far removed as one can imagine from monotony.

There are some disabilities inherent in agriculture and one is its relative unprofitableness. But that, in my opinion, is one of its redeeming features, in that it remains as a pursuit of choice, to which men are drawn not by the love of lucre but by the higher desires and aspirations. There is one other disability, namely the large element of chance that interferes in the pursuit of agriculture, the great number of uncontrollable factors with which the farmer has to meet. While that is a disability it is also an opporunity for the exercise of trained intelligence.

When these disabilities are removed there remain freedom, interest, variety and — will you allow me to add — honor and dignity.

I have tried to set forth something that might be called a body of principles and in so far as you can agree with me, think what a force this meeting and similar meetings will mean in your various pursuits, the moulding of right and true opinions with respect to the institution that you represent and particularly the moulding and directing of opinions with respect to the great and honorable pursuit of agriculture.

Concerning the C. S. T. A. and Its Branches

BY THE GENERAL-SECRETARY.

During the months of April and May, plans will be completed for the holding of the first Annual Convention in Winnipeg. Nominations are now being received by the General Secretary, for the positions of President, First Vice-President, Second Vice-President and Honorary Secretary-Treasurer. An election will be carried on in April by mail ballot, when every member will have an opportunity to indicate his choice for each of the four positions named above. The nine provincial executive committees will each name, before May 15th, one representative to hold office for one year. The complete new Dominion Executive Committee, with thirteen members, will hold its first business meeting at the close of the Convention.

It has been decided to hold the Convention on June 15th, 16th and 17th, and *every member should make a special effort to be in Winnipeg at that time.* Official delegates, in the proportion of one to every twenty members, will be sent by each local branch and will be given full voting privileges at the Convention. Other members in attendance, will, it is hoped be prepared to take part in the discussions upon the many important matters coming up for consideration.

Between now and the time of the Convention the General Secretary will keep in the closest possible touch with the Dominion Executive, the local and provincial committees and the individual members, partly through these columns and partly by direct correspondence. Every effort will be made to give advance publicity to the date and place of the Convention, in order to ensure as large an attendance as possible; similar publicity will subsequently be given to the addresses, discussions, resolutions and reports, presented during the meetings.

A tentative programme is now being drawn up for the consideration and final approval of the Dominion Executive. The General Secretary will move his headquarters to Winnipeg at least two weeks in advance of the meetings, in order to give personal attention to many local details. A special Convention number of "Scientific Agriculture" will be published at the end of June.

Members of the C.S.T.A. are earnestly requested to submit to the General Secretary, especially during the month of April, any suggestions that will be helpful

in planning the details of the Convention. Any matters that should be placed on the agenda for the business sessions, any subjects requiring presentation in the form of an address, the names of any speakers qualified to deal with such subjects, suggestions as to the social part of the programme, will all be gladly received and considered. The closest possible co-operation, in the strictest sense of the expression, is necessary in order to ensure success.

BRITISH COLUMBIA BRANCH.

The first annual meeting of the B.C. Branch was held in Vancouver on March 1st, 2nd and 3rd. The fact that the meetings extended over a period of three days is an indication of the live interest being taken in professional agriculture in the Pacific province. The first day was devoted to business sessions, to a consideration of agricultural policies, soldier settlement work, and dairy farm survey work. A banquet was held in the evening, at which the Hon. E. D. Barrow was present and spoke. During the second day, practically every phase of agricultural work was dealt with by competent speakers: dairying, poultry, live stock, horticulture, entomology, irrigation, agronomy, all with special reference to the province of British Columbia. The relation of the Experimental Farms System to Provincial Agriculture and the question of High School Education were also on the programme for the second day.

During the third day the members were divided into sections for a more careful and detailed consideration of matters bearing directly upon their respective lines of work.

A detailed report of the meetings has not yet been received, but several of the papers given will be published in the April issue. The foregoing is merely a brief outline, taken from the printed programme.

SOUTHERN SASKATCHEWAN BRANCH.

On the evening of Friday, March 4th, a banquet was held in Regina by the Southern Saskatchewan Branch of the C.S.T.A. followed by a regular meeting of the members. An address was given by Mr. N. MacKenzie, Superintendent of the Experimental Farm at Indian Head, in which the speaker outlined the growth, present work and future plans of the Dominion system of Experimental Farms. Mr. F. H. Auld, Deputy Minister of Agriculture for Saskatchewan, Mr. P. E. Reed, Dairy Commissioner, and Mr. Geo. Ewart, of the Soldiers' Settlement Board, expressed appreciation of the valuable service being now rendered by the experimental farms, and interest in the plans being formulated for future effort.

The remainder of the meeting was devoted to a consideration of business matters.

WESTERN ONTARIO BRANCH.

At a meeting held at the Carls-Rite Hotel, Toronto, March 10th, it was decided to organize a Western Ontario local branch of the C.S.T.A., to include all members resident in central and western Ontario, who are at present about eighty in number. The General Secretary presided and received nominations for the positions of President, Vice-President and Secretary-Treasurer. An election is now being conducted by mail ballot.

The formation of a Western Ontario Branch completes the Dominion-wide organization of the C.S.T.A.

EASTERN ONTARIO BRANCH.

The annual business meeting of this branch was held at the University Club, Ottawa, on Friday, March 11th. The election of officers for the coming year resulted in the following. President, G. H. Clark, Dominion Seed Commissioner; Vice-President, W. R. Reek, Assistant Live Stock Commissioner, Ottawa; Secretary-Treasurer, O. C. White, Soldiers' Settlement Board, Ottawa.

Consideration was given at the meeting to the programme for the Winnipeg Convention, tentative plans for which were outlined by the General Secretary.

QUEBEC LOCAL BRANCHES.

Business meetings of the three local branches in the Province of Quebec have been held recently as follows: Macdonald College Branch, March 14th; Quebec City Branch, March 15th, Montreal Branch, March 17th. There was a good attendance at each of these meetings and consideration was given to the election of officers, nominations for the Dominion Executive, the programme for the annual convention and other matters. The new officers for the Macdonald College Branch are Prof. B. T. Dickson, President; M. A. Jull, Vice-President, and L. C. Raymond, Secretary-Treasurer. The Montreal Branch re-elected its present officers, who are President, Dr. A. T. Charron; Vice-President, J. E. Montreuil; and Secretary-Treasurer, F. Letourneau. The officers of the Quebec Local Branch are being elected by mail ballot.

The General Secretary was able to attend each of the three meetings in the Province of Quebec.

ORGANIZATION OF THE PROVINCIAL O.A.C. ALUMNI.

Thursday, March 10th, 1921 was O.A.C. Day in Toronto. At the Prince George Hotel, where the business proceedings commenced officially at 3 P.M., many groups of old college friends could be seen, and the enthusiasm that prevailed during the business meeting and at the evening banquet was a striking evidence of the keen college spirit existing among even the oldest graduates of the college.

Mr. C. F. Bailey who was chairman of the Organization Committee was elected president of the Provincial O.A.C. Alumni, an organization which, judging from its constitution, will do much to further the interest of the O.A.C., to foster a spirit of comradeship among its members and to assist in the advancement of agriculture in the province. Mr. W. P. Gamble, formerly associate professor of chemistry at the O.A.C. and now President of The White Lime Co., at Guelph, was elected Vice-President and Mr. S. E. Todd, Secretary-Treasurer. It should be added that Mr. Todd was Secretary of the Organization Committee and was largely responsible for the success which attended the Toronto meeting.

In accordance with the constitution, twelve directors were appointed, three from each of the four electoral districts into which the Province was divided; these were as follows: Eastern Ontario, A. P. MacVannel, J. W. Kennedy and W. R. Reek; Western Ontario, W. H. Porter, G. G. Bramhill and H. H. Revill; Central Ontario, J. B. Fairbairn, F. N. Marcellus and J. W. Widdifield; Northern Ontario, Chas. Laidlaw, L. M. Davis and Tennyson Jarvis.

CHANGES IN ADDRESSES.

The following changes in addresses of members should be noted:

D. Frejd, Dryden, Ont.

A. J. Logsdail, R. R. 3, St. Catharines, Ont.

E. P. Bradt, Niagara-on-the-Lake, Ont.

J. H. King, Moncton, N. B.

J. H. Cockell, c/o Gifford & Co., Portland, Ore.

B. B. Richardson, College of Agriculture, Milford, N. H.

APPLICATIONS FOR MEMBERSHIP.

Davis, R. L. (Montana, 1919, B. S.) University of B. C., Vancouver ,B. C.

Derick, R. A. (McGill, 1920, B. S. A.) University of B. C., Vancouver, B. C.

Emslie, B. L., Central Experimental Farm, Ottawa.

Green, John H. (Manitoba, 1915, B. S. A.) Boharm, Sask.

Helmer, R. H., Supt. Experiment Station, Summerland, B. C.

Iwanami, J. (Toronto, 1912, B. S. A.) Victoria, B. C.

LaPierre, L. A. (Toronto, 1903, B. S. A.) Chilliwack, B. C.

McIntosh, Geo. E., in charge of Transportation, Dominion Fruit Branch, Ottawa.

McMeans, A., Dominion Seed Branch, Vancouver, B. C.

McRostie, G. P., (Toronto, 1912, B. S. A., Cornell, 1919, Ph. D.) Macdonald College, P. Q.

Neely, R. W. (Saskatchewan, 1919, B. A.) Dept. of Agriculture, Regina, Sask.

Shales, J. M. (Queens, 1914, B. A.; Toronto, 1919, B. S. A. Murrayville, B. C.

Shaw, W. R. (Toronto, 1916, B. S. A.) Moncton, N. B.

Waddell, Jas. (Saskatchewan 1920, B. S. A.) University of Saskatchewan, Saskatoon.

The personnel of the Editorial Board of Scientific Agriculture will be announced in the April issue, and will be reviewed at the Annual Convention of the C.S.T.A. in June next, when definite duties will be assigned. In the meantime, it is intended to function mainly as a consultative body and to pass upon the merits of technical papers submitted for publication.

Agricultural Production in the Province of Quebec
Production Agricole dans La Province de Québec

COMPARISON BETWEEN 1911 AND 1920—COMPARAISON ENTRE 1911 ET 1920

Field Crops—Récoltes des Champs

	1911 Superficie ensemencée Area seeded	1911 Production Yield	1911 Valeur Value	1920 Superficie ensemencée Area seeded	1920 Production Yield	1920 Valeur Value
	acres	boisseaux bushels		acres	boisseaux bushels	
Blé Wheat	68,999	1,223,000	$ 1,443,000	222,045	4,163,000	$ 8,456,000
Avoine Oats	1,430,209	37,500,000	19,875,000	2,205,908	66,729,000	58,722,000
Seigle Rye	12,735	200,000	202,000	28,462	534,000	1,004,000
Orge Barley	99,762	2,271,000	1,771,000	194,444	4,910,000	6,923,000
Pois Peas	32,507	517,000	708,000	60,870	1,035,000	3,478,000
Fèves Beans	6,065	114,000	225,000	35,835	645,000	2,632,000
Sarrasin Buckwheat	112,880	2,548,000	1,886,000	151,765	390,800	5,393,000
Grains mélangés Mixed grains	114,347	2,925,000	2,018,000	143,423	4.195,000	5,286,000
Lin Flax	1,146	13,000	22,000	16,035	184,000	657,000
Maïs à grains Corn for husking	23,473	712.000	719,000	47,741	1,420,000	2,258,000
Pommes de terre Potatoes	124,381	15,763,000	10,561,000	310,692	57,633,000	57,633,000
Plantes-racines Roots	13,543	3,943,000	1,459,000	83,613	27,530,000	13,765,000
		Tonnes Tons			Tonnes Tons	
Foin et trèfle Hay and Clover	3,294,230	6,260,000	63,664,000	4,290,121	5,363,000	155.527,000
Maïs fourrager Fodder Corn	37,155	325,000	1.560,000	86,833	695,000	7,089,000
Luzerne Alfalfa	3,634	14.000	135,000	28,200	68,000	1,428,000
		lbs			lbs	
Tabac Tobacco	12,094	10,095,901		33,000	26,400,000	6,600,000

Total area seeded in 1911 .... 5,480,673 acres .... Superficie totale ensemencée en 1911
— — — in 1920 .... 7,905,987 acres — — — en 1920
Total value of field crops ...... $ 65,353,528 .... 1911 ...... Valeur totale de la récolte
— — — — — 330,251,000 .... 1920 ...... — — — —

Province of Quebec—Province de Québec

Dairy Industry—Industrie Laitière

	1911	1920
Butter Beurre	41,782,678 lbs valued at $9,961,732	37,681,366 lbs valued at $20,857,523
Cheese Fromage	58,171,091 lbs valued at $5,695,254	58,044,719 lbs valued at $15,305,488

The Department of Agriculture of Quebec maintains forty-three District Representative offices.

La Revue Agronomique Canadienne

Section Française de l'Organe Officiel

DE LA

Société des Agronomes Canadiens

Rédacteur: F. Létourneau.

L'Evolution de l'Agriculture

I

Erreur d'optique.

Les touristes, l'été, qui, paresseusement assis dans leur auto, se répandent, comme des nuées de sauterelles, dans nos campagnes, ne font pas que soulever, sur leur passage, des tourbillons de poussière, massacrante pour les piétons autant que pour les plantes, mais ils soulèvent aussi — on n'est pas citadin pour rien — des *questions sociales*.

L'agriculture, pour eux — ceux qui ignorent les choses de la terre — demeurerait pesamment immobile, résisterait aux ébranlements, aux lents glissements, aux brusques ruptures d'équilibre qui entraînent les autres classes. Les villes, parce qu'elles présentent, confondues dans la même trépidation, les images du luxe et de la misère, les conflits violents des patrons et des ouvriers, le déclin d'institutions traditionnelles, les progrès d'organisations nouvelles, parce qu'elles exercent une force d'attraction que l'on voit grandir chaque jour, contiendraient presque toute la vie de la nation. Les villes seules auraient évolué et les campagnes dormiraient toujours dans la routine.

Ceux qui jugent ainsi sont les victimes d'une erreur d'optiques. Les voyageurs de l'automobile peuvent se figurer que l'attelage du paysan qu'ils viennent de couvrir de poussière et de fumée était arrêté au bord de la grande route; c'est qu'ils n'ont pas eu le temps, pour juger de sa marche, de prendre des points de repère et de voir l'aiguillon dans la main du cultivateur. Le temps n'a pas la même mesure à la ville et aux champs. Habitué à l'agitation, on appelle immobilité la lenteur paysane.

L'agriculture n'est pas restée à l'écart du mouvement social. Ses transformations ont été moins brillantes et, sans doute, moins considérables que celles de l'industrie. Regardons cependant le chemin parcouru. Depuis une cinquantaine d'années, les cultivateurs ont modifié les procédés de culture, rajeuni leur vieilles terres, mis en service des machines et accru le rendement des récoltes. Les conditions de vente de leurs produits ont été bouleversées par la concurrence étrangère. Ils ont su prendre leur part du progrès général, bénéficiant des découvertes scientifiques, de l'amélioration continue des moyens de transports, de la diffusion de l'instruction. Ils ont tiré de l'association un parti merveilleux, etc.

Le paysan d'autrefois.

L'exploitation agricole d'autrefois constituait un groupe fermé, où les produits étaient consommés par ceux là mêmes qui les avaient créés, récoltés, approvisionnés, où l'échange avec d'autres producteurs était réduit à presque rien et prenait généralement la forme du troc, les produits s'échangeant contre d'autres produits sans l'intermédiaire de la monnaie. Le domaine rural assurait au propriétaire et à ses ouvriers le vivre et le couvert et leur fournissait encore les matières premières qu'ils transformaient eux-mêmes en vêtements, en meubles et en outils. C'était l'*économie domestique* ou *familiale*.

Le passage à l'agriculture moderne.

Multiples sont les raisons qui ont provoqué l'entrée des paysans dans l'organisation moderne du travail et de l'échange. Ce n'est pas sous la pression d'une force interne que la vie agricole a évolué. Isolées, livrées à elles-mêmes, les classes rurales auraient maintenu les formes primitives de leur organisation familiale parce que l'exploitation agricole peut facilement constituer un ensemble qui se suffit à lui-même, qui produit tout ce qu'il consomme. Si elles sont entrées dans la communauté économique, se spécialisant, jouant leur rôle dans la division du travail, participant à l'échange national et mondial des produits, à la vie politique et aux progrès des idées, c'est que des forces extérieures ont agi sur elles.

La cause essentielle, sinon la première dans l'ordre historique, des modifications sociales que nous observons, c'est la transformation des conditions de vente à mesure que les marchés urbains se développent et que les moyens de transport perfectionnés permettent de solliciter des régions rurales de plus en plus éloignés. L'amélioration des méthodes de culture est elle-même liée au progrès des sciences et des techniques qui a été réalisé dans les milieux industriels. La vie des hommes de la campagne a changé, elle se transforme encore sous nos yeux, parce qu'elle subit l'influence du milieu économique dans lequel elle baigne et l'on pourrait dire dans lequel elle se fond. On donne à cette observation son expression la plus générale, lorsqu'on dit que l'agriculture est passée de l'économie domestique ou familiale à l'*économie commerciale et capitaliste*.

L'agriculture moderne.

Delivré de l'obligation de récolter tout ce qui est nécessaire à ses propres besoins, l'agriculteur peut désormais se borner à produire ce qu'il obtient de son sol avec le plus de profit. Tout le reste, il le tirera du marché. L'agriculteur moderne produit, vend et achète. L'agriculture est désormais une industrie. Elle est "industrialisée" et "commercialisée."

Nous disons qu'elle est industrialisée et commercialisée parce qu'elle a dû imiter les méthodes de production et de vente de l'industrie, parce qu'elle est entrée dans le système économique moderne, caractérisé par la division du travail, la production de marchandises en vue de la vente, la concurrence entre producteurs.

Elle s'est industrialisée parce qu'elle a considérablement augmenté les moyens d'action du cultivateur dans l'oeuvre de la production, parce qu'elle a reculé la limite à partir de laquelle s'applique la loi du rende-

ment décroissant, parce qu'elle utilise les méthodes de la division du travail à l'intérieur des entreprises et recourt à la spécialisation des cultures, parce qu'elle emploie des machines, parce qu'elle augmente et régularise la production.

Elle s'est commercialisée parce que ses récoltes sont, presque toutes entières, destinées à être vendues, parce que le commerce des produits agricoles est organisé, qu'il a des cours réguliers qui s'imposent sur le marché national et subissent l'influence du marché mondial.

Ainsi l'agriculture moderne est constituée. Avec elle est née une science nouvelle: L'ECONOMIE RURALE. Qui n'appliquera pas ses principes périra...économiquement.

Avantage de la Classification des Produits Agricoles

Par le Dr A.-T. CHARRON, de St-Hyacinthe.

Il y a environ un an je faisais un relevé comparatif des prix payés pour le beurre par la Co-opérative Centrale des Agriculteurs de Québec et par les acheteurs s'approvisionnant à la halle au beurre de St-Hyacinthe, et voici les intéressantes constatations que j'ai pu faire.

Le prix moyen payé pendant six mois par la Co-opérative Centrale pour le beurre classé No 1 était de \$0.55.04 par livre et pour le No 2 il était de \$0.54.22 par livre, tandis que le prix moyen payé à la halle au beurre de St-Hyacinthe durant ces six mois était de \$0.53.32 par livre. La différence entre le prix moyen payé à St-Hyacinthe et le prix de la Co-opérative pour le beurre No 1 se chiffre à \$0.01.721 par livre et si la comparaison est faite avec les prix payés pour le beurre No 2 à la Co-opérative, nous avons encore un écart de .9 de cent en faveur du prix payé à la Co-opérative. En supposant que tout le beurre du district de St-Hyacinthe aurait été classé No 2, le cultivateur aurait encore reçu, en vendant après classification, .9 de cent par livre de plus. Examinons maintenant ce que cette différence représente pour la quantité de beurre qui se fabrique dans ce district.

La moyenne du lait reçu, par jour, durant un mois de cette période, dans chaque fabrique de St-Hyacinthe a été estimé à 7,989 livres. Le beurre obtenu, par jour, dans chaque fabrique a été estimé à 319.5 livres. En supposant que ce beurre aurait été classé No 1, le revenu de chaque jour obtenu par chaque fabrique aurait été de \$175.91. Si ce beurre avait été classé No 2, la même fabrique aurait eu un revenu de \$173.25 en le vendant au prix de la Co-opérative après classification, mais vendu au prix moyen à la halle de St-Hyacinthe, ce beurre n'a apporté que \$1700.41, c'est-à-dire que les cultivateurs qui avaient apporté du lait à cette fabrique ont perdu dans le premier cas, si le beurre était No 1, \$5.50 et si le beurre était No 2, \$2.86 par jour. Nous considérons 25 jours de fabrication par mois. Nous pouvons donc estimer que chaque fabrique du district de St-Hyacinthe a perdu de \$71.50 à \$137.50 par mois. Il est à remarquer que ces chiffres s'appliquent à une fabrique qui recevait la moyenne du lait apporté aux fabriques dans le district de St-Hyacinthe. Il existe, dans le district de St-Hyacinthe, quelques fabriques qui reçoivent jusqu'à 12,500 livres de lait par jour et qui fabriquent 500 livres de beurre. Dans une fabrique de cette importance les cultivateurs qui l'alimentent ont perdu \$8.60 par jour, si leur beurre mérite d'être classé No 1, soit \$215 par mois; en supposant que leur beurre eût été classé No 2, la perte par jour aurait été de \$4.50 et par mois, de \$112.50. En six mois, par conséquent, une fabrique de cette importance s'est trouvée privée d'un revenu maximum de \$1,290.00 ou d'au moins \$675. A supposer maintenant que nous considérions comme une très petite fabrique celle qui ne reçoit que 3,000 livres de lait par jour, une telle fabrique perdrait encore de \$27.00 à \$51.50 par mois. Dans la région de St-Hyacinthe, durant la période de six mois couverte par notre enquête, il s'est fabriqué chaque jour 11,504 livres de buerre. En supposant que tout ce beurre aurait été de première qualité, la perte subie se chiffrerait à \$198.08 et si ce beurre avait été de deuxième qualité, la perte se chiffrerait à \$103.53, ce qui représente \$4,951.00 par mois dans le premier cas et \$2,588 par mois dans le second cas. N'ai-je pas raison de dire que c'est faire acte de justice envers le producteur d'appliquer la classification aux produits agricoles. J'ai choisi pour illustrer ce point la vente du beurre parce que le beurre et le fromage sont les seuls produits agricoles vendus dans les endroits contrôlés permettant d'établir une comparaison.

S'il nous était possible de faire une enquête semblable pour tous les produits agricoles offerts en vente: les oeufs, la volaille, le bétail et les grains, je suis persuadé que le même raisonnement serait tout aussi approprié et les résultats en tout semblables.

Laissez-moi vous citer l'exemple d'une autre co-opérative, celle des Producteurs de grains de semence de Sainte-Rosalie.

Cette Société co-opérative a reçu dans son entrepôt durant la dernière année à peu près 70,000 minots de grain, tels que blé, orge, avoine, sarrasin et pois. Après avoir passé ce grain dans ses cribles et dans ses trieurs à alvéoles, elle a obtenu 40,500 minots propres à la semence, ne contenant aucune mauvaise herbe et possédant une qualité germinative de 98 à 100 pour cent. La quantité enlevée par le criblage et le triage fut de 29,500 minots, soit 42 p. c.

Si le grain eût été semé sans préparation, il aurait fallu 47,000 acres de terrain pour le semer; après le criblage, la quantité étant moindre, la superficie de terre requise n'était que de 25,000 acres. Il est donc resté 22,000 acres pouvant être utilisés pour d'autres fins.

Il a été prouvé, au moyen d'expériences répétés durant huit années consécutives que du grain préparé comme il l'est par la Co-opérative de Sainte-Rosalie rapporte une moyenne de 28 p. c. de plus. Ainsi, en calculant un rendement de 30 minots à l'acre, les 25,000 acres ont dû rapporter 750,000 minots. Avec du grain non préparé le rendement n'aurait été que de 575,000 minots. Ainsi l'emploi des semences que la Société a fourni a donné un surplus de rendement de 175,000 minots, tout en diminuant de 22,000 acres la superficie de terre ensemencée.

Aux prix auxquels les grains se sont vendus durant ces dernières années, il n'est certainement pas exagéré de dire que le surplus de récolte qui a été obtenu par l'emploi de telles semences est de \$10.00 par acre, soit \$250,000.00.

La récolte provenant de ces semences a un surplus de valeur d'au moins 10 cents par minot; en calculant une récolte moyenne de 30 minots à l'acre, il s'est récolté 750,000 minots de grain vendu à .10 de plus, soit \$75,000. Ainsi l'emploi de semences préparées par la Société Co-opérative de Sainte-Rosalie a rapporté aux cultivateurs

de la province de Québec un surplus de revenus évalué à $325,000.00.

Les mêmes machines ont préparé, à part la quantité mentionnée plus haut, 20,000 minots de grain pour le compte des cultivateurs des comtés avoisinants Sainte-Rosalie. Les revenus de ce grain peuvent être calculés dans les mêmes proportions.

On voit par là l'amélioration considérable qui a été obtenue dans la qualité des produits agricoles grâce à la classification. Cette amélioration, c'est un acte de justice, justice pour le fabricant dont la compétence ne doit pas être laissée dans l'ombre, justice et féconde émulation entre tous les fabricants, grâce à la perspective de voir leurs efforts publiquement appréciés et honnêtement rémunérés, justice envers le producteur consciencieux qui constate qu'il ne s'est pas donné de la peine en vain pour fournir au fabricant une matière première irréprochable sous tous rapports. Le producteur possède le strict droit de recevoir pour ses produits un prix proportionnel à leur qualité et ce prix il ne peut l'obtenir qu'en autant que ses produits lui sont payés d'après classification.

Evolutions dans l'Emploi des Insecticides et des Fongicides

Par le Rév. Père LEOPOLD,
Directeur de l'Institut Agricole d'Oka.

Je n'ai pas l'intention, dans cet article, de passer en revue tous les insecticides et fongicides qui ont servi à combattre les insectes et les maladies fongueuses depuis quelques années. Je me bornerai aux plus employés.

Arseniate de plomb vs. vert de Paris.

Jusqu'en 1911, on avait toujours eu recours au vert de Paris. A la suite d'expériences conduites à l'I. A. O., le vert de Paris a été mis de côté et remplacé par l'arséniate de plomb.

L'Arséniate de plomb est supérieur au vert de Paris et nous serions encore en droit de le recommander si l'on n'avait trouvé, depuis, un autre insecticide plus économique encore: l'arséniate de chaux.

L'arséniate de chaux possède sur l'arséniate de plomb de nombreux avantages. Lorsqu'on l'emploi avec la bouillie soufrée, il cause moins de dommages aux feuilles que l'arséniate de plomb. Celui-ci, en effet, se combinant avec la bouillie soufrée, donne naissance, entre autres, à de l'arséniate monocalsique qui, soluble dans l'eau, cause de graves brûlures aux feuilles. Ces réactions dans le cas de l'arséniate de chaux ne se produisent

Les pulverisations dans les vergers de l'institut agricole d'Oka.

pas. Il n'y a aucun inconvénient à employer l'arséniate de chaux en mélange avec la bouillie soufrée. De plus, l'arséniate de chaux coûte beaucoup moins cher que les deux insecticides précédents. C'est donc le plus recommandable des insecticides aujourd'hui.

Bouillie soufrée

Ce fut en 1911 qu'on employa, pour la première fois, la bouillie soufrée à l'I. A. O. Nous fûmes même les

Premier Arrosage.

premiers à l'employer dans la Province de Québec. Pour vulgariser l'emploi de cette nouvelle bouillie nous fîmes imprimer la manière de la fabriquer au moyen de la formule suivante:

50 lbs. de chaux vive.
100 lbs. de soufre.
40 à 50 gallons d'eau.

Le tout devait être bouilli à la vapeur jusqu'à ce que le soufre et la chaux fussent intimement mélangés pour produire un liquide rouge-cerise très vif après que le dépôt fût précipité au fond du récipient.

Pour prouver l'efficacité de cette nouvelle bouillie de nombreuses expériences furent conduites dans les vergers de démonstration de la province de Québec, et avec un tel succès que les experts furent unanimes à reconnaître la supériorité de la bouillie soufrée sur la bouillie de bordelaise.

Ce n'est que tout récemment que le professeur San-

Deuxième Arrosage.

ders de la Nouvelle-Ecosse annonça que la chute de la majorité des fruits des vergers de cette Provnce était directement attribuée à l'emploi de la bouillie soufrée. C'est vrai pour la Nouvelle-Ecosse.

Le problème des arrcsages semble être surtout une affaire locale. Si pour des raisons climatériques les vergers de la Nouvelle-Ecosse ne sont pas traités à la bouillie soufrée on ne peut en conclure qu'on doive proscrire l'usage de cette bouillie dans la province de Québec.

Nous avons donc entrepris, au printemps de 1919, une série d'expériences pour nous rendre compte des effets de la bouillie soufrée sur les fruits, comparés à ceux de la bouillie bordelaise. Des expériences furent faites dans le même verger et sur la même variété de pommes (Wealthy) dans des conditions par conséquent identi-

Troisième Arrosage.

ques de sol et d'exposition. Des experts, comme M. Petch, du laboratoire entomoligique de Hemmingford, M. Davis, assistant-pomologiste de la Ferme Expérimentale d'Ottawa, et M. Bunting du Collège Macdonald, après avoir visité les vergers dans lesquels on conduisait ces expériences, sont partis convaincus que la bouillie soufrée ne réduisait en rien la qualité et la quantité des fruits. On peut donc continuer sans crainte à employer la bouillie soufrée.

Arrosages et Pulvérisations.

S'il y eut des progrès réalisés dans les ingrédients eux-mêmes, employés contre les maladies des insectes, en ces dix dernières années, le progrès fut encore plus marqué dans le mode de leur application.

Pendant longtemps, on a cherché un moyen mécanique de pulvériser les fongicides et les insecticides sur les arbres sous forme de poudre pulvérulente. Il existe actuellement dans le commerce des machines à pulvériser de différentes marques.

Quatrième Arrosage.

Nous avons fait l'essai de ces pulvérisations depuis trois ans et nous en sommes satisfaits.

Le saupoudrage offre plusieurs avantages sur les arrosages. Il permet au propriétaire d'une grande exploitation de protéger son verger à des moments critiques ce qui lui serait impossible avec les arrosages. Entre le premier et le second arrosage le temps est par-

fois si court qu'il faut, ou omettre une partie des travaux ou les faire à moitié.

La préparation et le mélange des ingrédients servant aux pulvérisations sont des points importants dont il faut tenir compte. La pulvérulence du matériel est essentielle; car, dans les pulvérisations comme dans les arrosages, il est absolument nécessaire de recouvrir uniformément les feuilles et les fruits, ce qui s'obtient mieux lorsque l'insecticide et le fongicide sont pulvérisés sur les arbres sous forme de poudre pulvérulente. Les ingrédients grossiers ne flottent pas et ne se transportent pas comme les poudres. Alors même que les premiers arriveraient jusqu'au feuillage et aux fruits ils tomberaient rapidement, tandis qu'une couche de poussière adhère mieux aux arbres.

Le soufre est, de tous les matériaux qui entrent dans la préparation des fongicides en poudre, le plus important. On doit choisir du soufre finement moulu.

On doit apporter le même soin au choix de l'arséniate de chaux. Il doit être lui aussi, sous forme de poudre pulvérulente. Les expériences qui ont été faites jusqu'à ce jour indiquent que le meilleur véhicule à employer est le plâtre (talc) de la qualité désignée dans le commerce sous le nom de Terra alba. Nous nous sommes servis de cette substance dans presque toutes nos pulvérisations. On peut aussi employer de la chaux hydratée, mais le talc est préférable, vu que sa densité se rapproche davantage de celle du soufre.

Dans la lutte contre la tavelure et la pyrale, le moment choisi pour l'application de ce mélange est très important.

Il ne faut pas oublier que si nous voulons enrayer la tavelure ou plutôt la prévenir, il faut appliquer les pulvérisations sur le feuillage avant la pluie et non après. Les spores du champignon ne germent que dans l'humidité. Il est donc important que le fongicide se trouve sur les arbres avant que la pluie ne tombe pour empêcher cette germination. Lorsqu'on applique le mélange on doit éviter de passer trop près des arbres. Le mélange a le temps alors de se répandre en nuages avant d'atteindre le feuillage.

Bouillie Bordelaise en Poudre.

Nous avons expérimenté aussi à l'I. A. O., une nouvelle préparation, un mélange de sulfate de cuivre anhydre, de chaux hydratée et d'arséniate de chaux. Le sulfate de cuivre anhydre est le fongicide de cette préparation. L'insecticide est fourni par l'arséniate de chaux. La majeure partie du mélange et composée de chaux hydratée telle qu'on la trouve dans le commerce. La quantité de sulfate de cuivre qui compose ce mélange varie selon que l'application se fait dans le verger ou sur les pommes de terre et, par conséquent, selon la quantité de cuivre métallique ou d'arsénie métallique nécessaire pour combattre les maladies et les insectes.

Pour le pommier, on recommande 4 pour cent de cuivre et 1¼ pour cent d'arsénic, tandis que pour les pommes de terre, il faut une dose plus forte, soit 5 pour cent de sulfate de cuivre anhydre et 2 pour cent d'arsénic.

Pour arriver à ce but, il faut employer:
Pour le pommier

10 lbs. de sulfate de cuivre anhydre
5 lbs. d'arséniate de chaux
85 lbs. de chaux hydratée.

Pour les pommes de terre:

12½ lbs. de sulfate de cuivre anhydre
7½ lbs. d'arséniate de chaux
80 lbs. de chaux hydratée.

Pulvérisateurs

Comme les vergers de l'I. A. O. couvrent une étendue assez considérable, nous nous servons d'une machine puissante pour appliquer ces préparations. C'est l'appareil D 1 Niagara, pesant un peu plus de 300 livres et relié à un moteur de 3 C.V., Fairbanks-Morse, Modèle Z, que nous nous servons avec satisfaction.

La Compagnie "United Fruit Growers" de la Nouvelle-Ecosse vend d'excellentes machines adaptées à ce genre de travail.

Calendriers d'Arrosages et de Pulvérisations
1o.—*Arrosages*

Premier arrosage: (fig. 1). Quand les feuilles des boutons s'ouvrent et avant qu'elles n'aient ½ pouce de longueur: Bouillie soufrée: densité de 1.015 si le chancre du pommier est présent (5 gallons pour 95 gallons d'eau) densité de 1.010 si le chancre est absent (3 gallons pour 97 gallons d'eau.)

Arséniate de chaux: 2 lbs. en poudre si le pique-bouton se rencontre.

Deuxième arrosage: (fig. 2.) Quand les boutons à fleurs se séparent et rougissent, mais avant leur épanouissement. Bouillie soufrée: densité de 1.008 (2½ gallons dans 97½ gallons d'eau.)

Arséniate de chaux: 2 lbs dans 100 gallons de bouillie soufrée.

Troisième arrosage: (fig. 3). Quand les pétales des fleurs tombent, mais avant que le calice ne se ferme.

Bouillie soufrée: densité de 1.007 (2 gallons dans 98 gallons d'eau.)

Arséniate de chaux: 2 lbs. (c'est l'arrosage important contre la pyrale.)

Quatrième arrosage: (fig. 4) environ deux semaines après l'application précédente.

Bouillie soufrée: densité de 1.006 (2 gallons dans 98 gallons d'eau.)

Arséniate de chaux: 2 lbs.

N. B. Quand nous disons 5, 3, 2½ et 2 gallons dans 95, 97, 98 gallons d'eau, nous faisons allusion à la bouillie concentrée du commerce.

2o.—*Pulvérisations*

Trois applications seulement.
1.—Quand les boutons à fleurs se séparent.
2.—A la chute des pétales.
3.—Deux semaines plus tard.

A—"Si la tavelure est abondante."

55 lbs. de soufre pulvérulent
5 lbs. d'arséniate de chaux
40 lbs. de talc.

B—"Si la tavelure n'est pas trs nuisible."

15 lbs. de soufre
5 lbs. d'arséniate de chaux
80 lbs. de talc.

ou encore, si l'on veut substituer le sulfate de cuivre au soufre:

10 lbs. de sulfate de cuivre anhydre
85 lbs. de chaux hydratée
5 lbs. d'arséniate de chaux.

N. B.—Quand, au cours de cet article, il est question de pulvérisations et d'arrosages, il s'agit toujours de pulvérisations sèches et d'arrosages liquides.

La Revue Agronomique souhaite à l'Hon. Ministre de l'agriculture de la province de Québec un heureux voyage et un prompt rétablissement.

LE PUCERON DE LA POMME DE TERRE

Je veux dire quelques mots du puceron de la Pomme de Terre appelé, de son vrai nom, "Macrosiphum Solanifolii."

Cet hémiptère avec lequel le public n'est pas bien familier n'est pas inconnu des entomologistes. Aux Etats-Unis, il a été longuement étudié et décrit dans les endroits où il a fait des ravages. Les meilleures descriptions nous aident à peine à l'identifier tant il ressemble à ses congénères d'espèce différentes. La variété qui m'a intéressé est la verte. Ces pucerons comme les autres de la famille comprennent des femelles ailées vivipares, des mâles ovipares et des mâles ailés.

Je l'ai observé sur la ferme de l'Ecole d'Agriculture de Sainte-Anne de la Pocatière où j'étais chargé de faire les pulvérisations des pommes de terre. Les dommages qu'il a causé là l'an dernier sont considérables. Les pucerons envahissent de préférence les plants les plus robustes; dans l'espace de quelques jours, les plantes envahies jaunissaient puis se fanaient et séchaient bien vite. Il est évident qu'à partir de là, la croissance des tubercules était arrêtée. Le ravage de ces insectes ne s'est pas étendu au-delà des limites de la ferme, ce qui est heureux parce qu'une invasion de ce genre serait bien plus à craindre que les invasions ordinaires de la Doryphore. Celle-là, en effet, peut être assez facilement combattue, tandis que pour détruire les pucerons il faudrait un traitement bien plus compliqué. Ici, les insectes sont suceurs; ils ne travaillent pas sur les feuilles, mais en dessous; il faudrait donc pour les atteindre nous servir d'appareils lançant le jet en dessous des feuilles et comme la chose n'a pas encore été réalisée totalement pour les applications de bouillie bordelaise, elle ne se trouve pas plus parfaite pour l'application efficace dans le cas qui nous occupe. L'invasion dont je vous parle s'est faite dans la seconde partie de l'été, c'est-à-dire à partir du 10 août.

Le puceron dont il s'agit ne s'est pas attaqué seulement à la pomme de terre. Lorsqu'il se trouvait à proximité des arbres fruitiers, je l'ai souvent rencontré sur les feuilles de ceux-ci. Sur les arbres fruitiers, des applications de sulfate de nicotine en ont eu facilement raison, chose qui n'a pu se produire sur les pommes de terre à cause des appareils efficaces qui nous manquaient. La seule bouillie bordelaise n'a eu aucune action nocive sur ces bestioles.

Les larves de coccinelles friandes de pucerons se sont prodigieusement multipliées dans les champs où il s'en rencontrait.

Je crois qu'il ne faut pas s'alarmer à la suite de l'apparition purement locale de ces insectes mais il est bon cependant de les connaître pour savoir en arrêter, au besoin, une invasion toujours possible.

En feuilletant la littérature entomologique des Etats-Unis, j'ai constaté que plusieurs Etats, en particulier celui du Maine ont déjà souffert du puceron de la pomme de terre. Dans tous les endroits, après avoir essayé plusieurs traitements, on est toujours venu à préconiser les applications de nicotine comme les plus efficaces.

J'ai tenu à signaler le fait parce qu'il peut être d'une certaine importance économique de le connaître.

OMER CARON, B.S.A.
Entomologiste adjoint, P. Q.

N'oublions pas cette vérité que la verdeur du sentiment patriotique chez un peuple est proportionnelle à la puissance de ce peuple.

LA SECTION DE MONTREAL

Elle a tenu, à Montréal, le 17 du courant, une assemblée régulière, à laquelle assistaient un grand nombre de ses membres.

Son programme comportait la nomination des candidats à la présidence, vice-présidence et au secrétariat de l'exécutif national, ses propres élections et plusieurs problèms importants.

Nous donnons ici la résultat des élections et les principales résolutions adoptées par l'assemblée.

Le bureau de direction a été réélu, soit, comme prédent, le Dr. A.-T. Charron, vice-président, M. E. Montreuil, secrétaire, F. Létourneau.

Le *comité des règlements* se compose de M. A. Héroux (président), du Dr. Charron (vice-président) et de F. Létourneau (secrétaire); le *comité des membres*, de M. A. Plante (président), de M. R. Cossette, (vice-président) et de M. E. Thériault, (secrétaire); le *comité de propagande*, de MM. A. Gosselin (président), Ste-Marie (vice-président) et de A. Gagnon (secrétaire); *le comité de révision*, du Dr. Charron (président). de J. N. Ponton (vice-président) et de F. Létourneau (secrétaire); *le comité d'enquête*, de MM. A. Raymond (président), Ste-Marie (vice-président) et Ponton (secrétaire).

Plusieurs résolutions ont été adoptées dont voici les principales:

Considérant que cette assemblée est d'opinion que l'inspection des Ecoles d'Agriculture n'est pas ce qu'elle devrait être, il est proposé que le comité d'enquête provincial (composé de MM. A. Raymond, L. Brown et J. Simard) soit chargé d'étudier le travail du comité d'inspection des Ecoles d'Agriculture tel qu'il existe aujourd'hui et de faire à qui de droit les suggestions pouvant amener l'amélioration du travail du comité d'inspection.

Considérant qu'à notre assemblée générale du 3 décembre dernier nous avions adopté la résolution suivante:

Que la Société regrette la concurrence malheureuse que se font les co-opératives existantes dans la province et considère qu'il est opportun de favoriser l'unification de ces co-opératives afin d'obtenir un organisme de véritable co-opération;

Considérant que depuis les co-opératives centrales ont tenu leur assemblée annuelle et que l'une d'elle, le Comptoir co-opératif, s'est apposée, à son assemblée annuelle, à la discussion libre de la question de l'unification des sociétés co-opératives;

La Société des Agronomes Canadiens, section de Montréal, regrette l'attitude du Comptoir.

LA SECTION DE QUEBEC

Le 15 mars, la section de Québec tenait, dans cette ville, au cours de l'exposition provinciale de grains de semences, une importante assemblée dont le compte-rendu paraîtra dans le prochain numéro.

L'INDUSTRIE DU CARIBOU DANS L'ALASKA

Le gouvernement américain est en train de peupler l'Alaska de caribous. Il y en a 270,000 actuellement. En 1935, il y en aura 5,000,000, ce qui permettra d'en abattre annuellement 1,250,000, presque l'équivalent de 3,000,000 de moutons.

La viande du renne, l'année dernière, se vendait 24 cents la livre. On en expédiera 500 tonnes cette année.

Le nord du Canada couvrant une superficie de 2,000,000 de milles carrés, alors que l'étendue de l'Alaska n'est que de 200,000 carrés, il serait en état de produire des quantités formidables de viande.

Les Besoins des Plantes

Les plantes ne présentent aucune différence entre elles par leur composition *qualitative*, elles sont formées de quorotze éléments toujours les mêmes et toujours réunis. Néanmoins, les unes se plaisent dans certains sols où les autres refusent de prospérer; on constate aussi que, sur un même sol, la même plante ne peut réussir plusieurs années de suite sans le secours d'engrais abondants, tandis que d'autres plantes peuvent occuper la même place sans présenter les mêmes exigences. Il en résulte que les diverses plantes, manifestant des exigences variées, doivent, au terme de leur végétation, présenter des diffrences notables dans les proportions de leurs divers éléments, c'est-à-dire dans leur composition *quantitative*. De nombreuses analyses ont été faites pour rechercher la composition quantitative de chaque espèce végétale. Il y a une quarantaine d'années, un chimiste allemand, Emile Wolff, professeur à l'université de Hohenheim, dressa des tables de la composition des plantes, d'après les moyennes de toutes les analyses faites jusqu'alors. Ces tables ont acquis une grande célébrité, et elles ont servi, jusqu'ici, dans presque tous les calculs des agronomes sur les exigences des récoltes.

Le but poursuivi par Wolff était de fournir un guide pratique aux agriculteurs pour le calcul approximatif de l'épuisement du sol par les récoltes et des restitutions à opérer par les engrais pour en maintenir la fertilité. Ses tables ont rendu les services qu'en attendait leur auteur pour des calculs n'exigeant pas une grande précision; mais, au point de vue scientifique, elles sont entachées d'un vice radical: elles supposent à l'espèce végétale une fixité de composition que celle-ci ne possède pas. Au rebours de l'espèce minérale, toujours caractérisée par la même forme et la même composition chimique, l'espèce végétale a une composition variable suivant son degré de développement, son âge physiologique, la nature du sol sur lequel elle a poussé, Deux échantillons de blé, par example, cultivés dans des conditions différentes, peuvent présenter, dans les proportions de leurs éléments constituants, des écarts bien plus importants que des végétaux n'appartenant pas à la même espèce, tels que le blé et le sarasin. C'est que le végétal est un être vivant, se développant par absorption de matériaux divers, qui subissent dans ses tissus des réactions variées dont le résultat est la formation d'espèces chimiques fort différentes de celles primitivement absorbées.

Les racines possèdent évidemment la faculté de choisir, parmi les matériaux du sol, ceux qui leur conviennent particulièrement; en effet, deux plantes d'espèce différente, cultivées côte à côte dans le même sol, n'en absorbent pas les éléments dans les mêmes proportions. Ce pouvoir sélecteur, dont les recherches des physiologistes n'ont pas encore bien défini les causes, peut s'expliquer, croyons-nous, par des considérations de plusieurs ordres. Au point de vue physico-chimique, les organes absorbants des racines sont de véritables dyaliseurs contenant un liquide beaucoup plus dense que celui qui les baigne extérieurement, ce qui détermine le mouvement d'absorption; mais le liquide contenu dans les cellules (la sève) contient en dissolution des substances qui exercent sur certains sels de la dissolution extérieure une attraction plus grande que sur certains autres; de là le passage des premiers en plus grande quantité. Ces préférences sont gouvernées par la nature particulière des produits que la plante-mère a réuni dans la graine et dans l'embryon. D'autre part, la finesse et la forme même des pores doivent varier d'un végétal à l'autre; les cellules absorbantes doivent donc tamiser différemment les molécules diverses que le liquide ambiant offre à leur absorption. De là une influence spéciale qui vient s'ajouter à celles d'ordre physico-chimique pour déterminer le choix que la plante pourra faire parmi les divers sels contenus dans le sol.

Ce premier choix fait par les racines est toujours très imparfait. En même temps que les molécules attirées par le contenu des cellules et nécessaires au développement de la plante, les pores en laissent passer d'autres moins utiles ou même complètement inutiles, si bien que la composition particulière du sol ne laisse pas que d'exercer une certaine influence sur la composition des végétaux qu'il nourrit. Le blé, par exemple, pris dans son ensemble, paille et grain, sera plus chargé de chaux sur un sol calcaire que sur un sol pauvre en chaux.

La composition quantitative du végétal se trouve donc déterminée par deux ordres d'influence:

1o.—Par son organisation spéciale lui créant des besoins particuliers et des organes spécialement construits pour s'emparer des éléments du sol capables d'y répondre;

2o.—Par la composition du sol et par les influences extérieures qui favorisent ou entravent plus ou moins le fonctionnement de ces organes, et, par suite, la satisfaction des besoins de la plante.

HENRI JOULIE.

NOS AMIS NOUS ECRIVENT

La puissance et la prospérité de notre agriculture repose et reposera de plus en plus sur la science agronomique, sur les découvertes des Lavoisier, des Liebig, des Pasteur, des Boussingault, des Berthelot, des Georges Ville, des Muntz, des Girard, des Lawes, des Schultz, des Kellner, etc.

La tradition et l'empirisme doivent céder le pas à la culture moderne, raisonnée.

La vulgarisation scientifique s'impose donc.

D'un autre côté, ainsi que le dit bien M. Jules Méline, ancien ministre de l'agriculture de France, la science agronomique est en perpétuel enfantement et les progrès d'aujourd'hui peuvent être détrônés par les progrès de demain.

Donc, l'oeuvre de vos grands devanciers que je citais tout à l'heure doit être poursuivie. Les expériences, les recherches ne doivent avoir de cesse...

Or, c'est vers ce double but, messieurs les agronomes du Canada, vulgariser la science agricole, étendre sans cesse, comme dit Jouzier, les limites de l'inconnu, que vous orientez votre Société.

Comment pourrais-je ne pas m'en réjouir et vous en féliciter.

Votre bien dévoué,

J.-E. CARON.

Ministre de l'Agriculture.

COLLABORATION

La Revue Agronomique compte sur la collaboration de tous les membres de la Société.

A partir du mois d'avril, elle mettra à la disposition des agronomes de district une bonne partie de ses pages.

Les monographies, etc., que ces messieurs voudront bien lui envoyer seront intéressantes pour ses nombreux lecteurs.

INDUSTRIES AGRICOLES ET ALIMENTAIRES.

Voilà les industries les plus considérables du pays. En 1915, si au groupe "Produits alimentaires" du recensement postal, on ajoute la valeur des boissons et des tabacs — qui sont des industries agricoles — on voit que cet ensemble représente plus de 30 pour cent du total de la valeur des produits canadiens. Nous subvenons assez bien à nos besoins alimentaires et nous exportons des produit agricoles. C'est notre force; mais gardons-nous de la croire immuable. Nous avons à progresser si nous voulons garder notre réputation de nation agricole et nous avons à nous améliorer encore passablement. Nous manquons parfois de diversité et nos fabrications pourraient être encore plus soignées, elles ne soutiennent pas toujours brillamment la concurrence pour la qualité. Quelques ombres au tableau ,la main-d'oeuvre se rarefie et partant devient chère; l'aisance de nos campagnes "narcotise" si on peut dire nos producteurs, une génération travaille, l'autre se laisse vivre, la troisième vient en ville se distraire et végéter. Il n'y a pas assez *d'industries agricoles dans les campagnes* et pas du tout de petites industries, nous comptons trop d'oisifs hommes et femmes. Que répondre au raisonnement suivant: "Monsieur, j'ai quatre fils, en ville, ils gagnent à eux tous $400 par mois. Je ne puis leur donner cela sur ma terre." Nous en sommes là.

LOUIS BOURGOIN.

NOTRE RICHESSE AGRICOLE.

La valeur (prix moyens payés aux cultivateurs) de la production agricole, au Canada, en 1919, était de $1,975,841,000:

Récoltes	$1,452,437,000
Animaux domestiques	180,084,000
Laine	11,000,000
Produits laitiers	252,320,000
Fruits et légumes ..	40,000,000
Volailles et oeufs ..	40,000,000
	$1,975,841,000

Si nous ajoutons à ce chiffre: $2,792,229,000 pour le sol, $927,548,000 pour les bâtiments, $387,079,000 pour les instruments aratoires et $1,102,261,000 pour le cheptel, nous obtenons la somme de $7,379,299,000, représentant la richesse agricole du Canada pour l'année 1919.

CHEZ LES MEMBRES DE LA SECTION DE MONTREAL

La commission du service civil d'Ottawa vient d'arrêter son choix sur M. J.-A. Ste-Marie comme propagandiste en zootechnie pour la province de Québec.

Etant le fils de l'un de nos principaux éleveurs de bétail Ayrshire, à Compton, M. Médéric Ste-Marie, ayant agi pendant cinq années comme adjoint au service de la production animale de la Ferme Expérimentale Centrale d'Ottawa, M. Ste-Marie était tout désigné pour cette fonction.

M. C.-A. Fontaine suit actuellement les cours de l'Institut National Agronomique de Paris.

M. G. Toupin poursuit ses études à l'Université Cornell.

Le Dr Sylvio Lafortune a été élu président de l'Association Avicole de la province de Québec et M. Aimé Gagnon, professeur à l'Institut Agricole d'Oka, l'un des directeurs.

Habitués à attendre, les cultivateurs ne se précipitent pas et ont connu le besoin salutaire de réfléchir avant d'agir. Lentement, mais sûrement, telle est leur méthode. L'orientation du sillon leur a donné cette habitude, et sachant bien où ils vont, ils ne risquent pas de manquer leur but.—Mgr Roy.

VOLUME I. APRIL, 1921. NUMBER 4

Scientific Agriculture

HON. MANNING W. DOHERTY
Minister of Agriculture for Ontario

La Revue Agronomique Canadienne

Canadian Society of Technical Agriculturists

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Scientific Agriculture

Official Organ of the Canadian Society of Technical Agriculturists

A Magazine devoted to the general advancement of Agriculture in Canada.

Published in the interests of Agricultural Science and Research.

Vol. I. Gardenvale, P. Q., April, 1921. No. 4.

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Published Monthly by the Industrial and Educational Publishing Company, Limited, Garden City Press, Ste. Anne de Bellevue, P. Q. 'Phone 165.

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Editor and General Secretary—FRED. H. GRINDLEY.

Subscription to any address in Canada, the United States, or the British Empire, $2.00 yearly; other countries, postage extra

Changes of advertisements should be in the Publishers' hands ten days before the date of issue.

La Revue Agronomique Canadienne

:-: EDITORIAL :-:

HIGHER EDUCATION.

It has been contended, by writers and thinkers whose opinions should carry some weight, that education is fundamental to an advancing civilization. The claim is—and it would appear to be almost axiomatic—that as our system of teaching improves, as our knowledge widens and is carried further afield, and as new principles are applied, so there is a gradual improvement in the efficiency of the people. This improvement is noticeable in the community as well as in the race. We have progressive districts and backward districts, the former introducing modern methods and applying modern principles, the latter through ignorance or disinterestedness, remaining years or decades behind the times.

How far is it necessary to carry educational systems in the interest of community and national life? Many a young man or woman has struggled through primary schools, high schools, colleges and universities, carrying through them all a conviction that the more knowledge they acquired the greater would be their success in life. In most cases the money and the efforts spent are not now regretted, but in some instances these men and women feel that they are not receiving an adequate return for their investment. Their opinions are aggravated by the knowledge that higher salaries are being paid both to unskilled labor and to employees whose training and education are less than their own.

Too much condemnation is bad for any system. Education throughout the ages has advanced civilization; lack of education will, per contra, result in backwardness and inertia in a community or in a country. Higher education, the knowledge and experience gained in university life, is a very necessary, if not an essential, addition to the training previously received. The fact that the merits of higher education are being questioned may be attributed to one of two causes—either to the policies which govern the salaries of trained experts, or to the experts themselves. If a policy of promotion by the merit system is being carried out, then the cause for any dissatisfaction may be traced to the dissatisfied individual, who is either incompetent or unaggressive. If a competent man or woman is not receiving adequate recognition or ample scope for work, there must be something wrong with the policy which governs that position.

The criticism of higher education on the part of individuals, will in the aggregate harm the system. How much more harm will be done by the criticism of a government! A press statement issued early in April made the astonishing announcement that an appropriation of $672,000, sought by the University of British Columbia to care for the twelve hundred students who will seek admission this year, was pared to $445,000. The result is that the University finds itself, (in addition to having to work under trying conditions as to buildings and equipment) faced with the possibility of having to restrict the number of students and of meeting interference with its educational work. It is further added that the curtailment of the University grant met with the approval of the Provincial Premier. It appears that the Hon. John Oliver is not a strong advocate of higher education, having spent only a brief part of his own youth in school and having made a success of life despite that fact.

Contrast this condition of affairs in British Columbia with the condition of affairs in the Province of Quebec where, as the result of the recent session of the Legislature, each of the three universities of Laval, McGill and Montreal were given one million dollars, and where particular consideration was given to educational matters generally. The same daily press which made the astonishing announcement in regard to the Province of British Columbia, has this to say of Quebec: "The Government has done a notable thing, which will be of the greatest possible benefit to the province in the years that are to come, for the higher education in any community marks a pronounced efficiency in every vital regard."

As we go to press we learn that, in the Ontario Legislature, Hon. R. H. Grant, Minister of Education, stated that arrangements had been completed for adequately financing Toronto University, Queens University and Western University. The amount of money assigned to each of these institutions for the present year is considerably larger than in 1920, when the expenditure for education had increased by $1,600,000.

ANSWERING A CRITICISM.

We have permitted our modesty to govern our pen for three months. We have allowed three issues of this new magazine to be printed without giving any indication of the reception accorded to it by its readers. We would hesitate to give that information now were it not for the fact that we wish to encourage further expression of opinion by placing before our readers a digest of what has already been said. Publicity has established itself as a business method adopted to accomplish quick results. The sooner we receive frank

comments and criticism, the sooner will we be able to make desirable changes and improvements to the magazine.

Scores of favorable opinions have been received from all manner of sources. The magazine is undoubtedly filling a new field and its entry into that field has been welcomed. But there has been some criticism and that was to be expected. One correspondent states that the magazine contains too much matter that is neither technical nor scientific and suggests that, as the official organ of the Canadian Society of Technical Agriculturists, its contents should be strictly limited to articles of that nature.

There are two main reasons why such a policy cannot be adopted now, if it is ever going to be adopted. One reason is that all the members of the C. S. T. A. are not actually engaged in scientific or research work. They may be journalists, or farmers, or extension workers, or men holding administrative positions. These readers are just as much interested in agricultural education, extension, history, etc., as they are in articles emanating from the laboratory. We are not able to say just what percentage of the members in the C. S. T. A. are engaged in research work, but the figure would certainly not be higher than 25 per cent. The wishes of the other 75 per cent must be met as far as possible since *Scientific Agriculture* is equally their official organ.

The second reason is that those controlling the magazine must constantly bear in mind that its success depends upon its circulation. A magazine with a subscription price of $2.00 per annum cannot succeed with a small exclusive list of readers, and outside of the members of the C.S.T.A., the number who would be interested in a strictly scientific publication is very limited.

Our policy so far has been to accept and publish any article dealing with agricultural research, if it was suitable and that policy will continue. In other words *Scientific Agriculture* offers an outlet for the results of experimental and research work, provided that articles giving that information are sent in for publication. But the magazine in its present size and form cannot be published monthly if it contains nothing else, because the amount of such material is not sufficient to fill the space available. And it is very doubtful whether a strictly technical publication could be maintained without considerable financial assistance.

There does not appear to be any logical argument against the publication, in *Scientific Agriculture*, of suitable articles dealing with other branches of the subject than research and experimentation. On the other hand, the arguments in favor of more diversified articles are many. If there is any material appearing in this magazine which more properly belongs to the practical farm papers, the publishers or owners of those papers would be the first to call our attention to the fact. In our first issue we stated that we had no intention of trespassing upon their field and we intend to stand by that statement. Not all of the articles submitted to us have been published and so far the agricultural press has given a very cordial reception to *Scientific Agriculture*.

This is an infant publication, seeking to build up a circulation and to make itself favorably known. When it is soundly established it will be in a better position to adopt such a policy as is indicated in the only criticism so far received—a criticism which, if acted upon, would unquestionably restrict circulation and present many difficulties.

PROMOTING AGRICULTURAL KNOWLEDGE.

There can be no doubt that some of the decisions reached at the Fifth General Assembly of the International Institute of Agriculture will, in the course of time, give a noticeable impetus to the progress of the agricultural industry. The reorganization work recommended at this Assembly which was held at Rome in November last, indicates recognition on the part of the Institute, of the value of obtaining sound counsel in matters agricultural and of furnishing to all countries, through recognized national organizations, the information and advice so obtained. This, in brief, is the import of two resolutions quoted in the December issue of the "International Review of Agricultural Economics", now before us.

The first resolution provides for "Consultative Committees", formed by the Permanent Committee, with the help of the Governments; the advise of the experts and technicians on these committees is to be given to each of the three branches of the Institute: General Statistics, Agricultural Intelligence and Plant Diseases, and Economic and Social Intelligence. The consultative committees are to meet annually, but are to give advice to the Permanent Committee by correspondence throughout the year.

The second resolution goes one important step further and states "That the Institute may put itself in relation, whenever it may deem it useful to do so, and after having the approval of the Governments concerned, with the agricultural organizations and associations of the different countries, in order to be more fully informed regarding all questions relating to the protection of the interests common to all the agricultural classes and to the betterment of their condition."

The efficient carrying out of these two decisions, which have been chosen from a number of other equally important decisions and resolutions passed at this Assembly, will do much to widen the knowledge of agriculture and to furnish those who are directly interested, with information they seek and need. It is an indication, on the part of the International Institute of Agriculture, of a desire to give wholehearted and unselfish support to an important movement: the public recognition of agriculture as a science.

Alfalfa Seed Growing in British Columbia

By P. A. BOVING,
Professor of Agronomy, University of British Columbia.

With the expansion, during the last thirty years, of the acreage planted to alfalfa, the demand for alfalfa seed has steadily increased. Some years ago a man had to be satisfied as long as he got alfalfa seed that would germinate. Today we are more particular. Practically every farmer knows he wants not only an alfalfa of satisfactory purity combined with a high percentage of germination, but he demands also to obtain such varieties as Grimm, Baltic or Canadian Variegated, all alfalfas belonging to the variegated group. These, as most of us know, are more resistant to adverse winter conditions than ordinary varieties, and give the most satisfactory results where winter killing constitutes a serious factor.

Botanically the variegated alfalfas are known under the name of *Medicago media*, which, as the name would indicate, stands in the middle between the two other common types, the *Medicago sativa* and the *Medicago falcata*. The former is generally a tall growing, blue flowered, the latter often a somewhat procumbent, and always yellow flowered alfalfa. In the media strains, a variety of flower colours prevail: purple, cream, yellowish, greenish, and brownish shades appear in the bloom indicating the mixture of the blue sativa blood with the yellow falcata blood. The medias are further characterized by closely set and branching crowns and by a strong development of roots with a tendency towards spreading, which they have inherited through the falcata parentage. This type of crown and root does not heave or winterkill nearly as badly as the straighter rooted and higher crowned alfalfas of the sativa type.

There are, as may be readily understood, great possibilities in alfalfa breeding, but the average farmer and seed grower can hardly afford to wait for results of his own selection, hybridisation and comparative testing. To him alfalfa seed production will mean a matter of securing stock seed of an outstanding strain and of multiplying such seed.

Right here it might be proper to observe that the seed grower should endeavour to secure stock seed from a strain with natural high seed producing capacity, as it has been found that alfalfas differ considerably in this respect, in that:

Certain strains and plants almost refuse to self fertilize,

Certain strains and plants are only medium selfers, whereas

Certain strains and plants self fertilize very readily.

This applies to individual plants within a variety or strain as well as to different varieties in comparison with each other.

We have had a very striking and, to us, a rather discouraging evidence of this fact in our work at Point Grey. Some years ago President Klinck, who was then Head of the Agronomy Department, selected a falcata plant which showed several good qualities such as drouth resistance, winter hardiness and spreading ability. When discussing the possibilities of this plant, we thought that it might fit in under interior B. C. pasture conditions. However, when trying to obtain seed from a number of individuals belonging to this family, which had been propagated vegetatively, we found that they practically refused to set seed. There was consequently nothing else to do but to arrange for some cross fertilization, and the following year we therefore left a few Grimm plants to flower on the outside of the falcata patch. We had also the satisfaction to obtain a certain amount of seed. While the pregeny from this seed shows considerable variation, it contains, at the same time, a number of promising seed producing individuals which seem to combine in themselves the good characters of both parents, and which may be found suitable for the conditions already referred to.

In 1906 this continent, including Canada and the United States, imported in the vicinity of one hundred thousand bushels, or six million pounds, of alfalfa seed. Although since then the import has diminished so that in 1916-1917 it amounted to only one-half, or fifty thousand bushels (three million pounds), there is nevertheless still room for anyone who would care to produce alfalfa seed. It should be recognized, however, that alfalfa seed growing is a very problematic proposition, unless conditions are favourable.

It must be frankly admitted that until relatively recent date considerable confusion prevailed in regard to reasons for success or failure in alfalfa seed production. Of course it has been recognized for a long time:

1. That the soil must be sweet, i.e., contain sufficient lime.
2. That bacteria must be present, i.e., that inoculation is necessary where corresponding organisms are lacking.
3. That the soil must contain P. and K. so that the plants may be in a position to benefit fully from their co-operation with the N-gathering bacteria.

But the influence of the stand itself, as well as of the weather during the growing season, has not been recognized to its full extent until the last 15-20 years. Now one generally admits that the climate of a certain district is the limiting factor in alfalfa seed production, and that the current weather constitutes the major factor almost deciding the yearly yields.

In Canada commercial production of alfalfa seed has been confined almost exclusively to parts of Ontario and Southern Alberta. In the United States by far the major portion of alfalfa seed is grown west of the one-hundredth meridian where irrigation and dry land farming are practised, i.e., this industry is chiefly confined to Utah, Kansas, Nebraska, California, Arizona, Colorado, Oklahoma, Idaho, Montana and Wyoming. Of late years several farmers in B.C. have grown alfalfa successfully, and as more may contemplate to go in for this branch of seed production, it is important that we be fully aware of the factors which influence the seed yield in a favourable or unfavourable direction.

In humid regions the acreage of any consequence is limited to the thinnest stands on the driest lands, and even there the seed sets in fair quantities only in occasional droughty years. According to statements in American publications, it has been found regarding Kansas, which by the way is the transition region between the humid and arid portions of the United States, that in the western part, with its average annual pre-

cipitation of from 15 to 20 inches, good seed-crops are frequent. But in the centre and eastern parts of Kansas, where the precipitation ranges from 20 up to 45 inches per year, "profitable crops of alfalfa seed are secured only in such seasons when a corn crop fails on account of drouth."

Native and Natural Home Conditions.

Despite the world wide recognition of alfalfa as a food for live stock and as an improver of soils, and although for many years there has been a decided demand for good alfalfa seed, the greater part of seed production for export has been limited to Turkestan, Persia, Hungary, Spain, and Algeria. All of these countries have climates which, in important respects, are very similar to those of the Western Plains and Plateau-regions of this continent. Turkestan and Persia, for instance, which have been and are rather strong and reliable producers of alfalfa seed, present table lands whose vegetation is deprived of precipitation by surrounding mountain ranges during the summer, i.e., during the flowering season, and whose medium latitudes guarantee warm weather at this time. These regions have only moderately severe winters and tolerably hot summers, with temperatures ranging from 10 deg. to 10 deg.F. in the winter, and with a summer temperature rising to 95 deg. or even to 105 deg.F. The altitude varies from 1000′ up to 3000′ and more.

Optimum Temperature for Seed Formation.

Although freezing temperatures do not readily kill alfalfa, they retard its development and damage the foliage considerably. The seasons of growth and of harvest, therefore, must be entirely frost free, as the growing alfalfa plant is sensitive in this respect during the whole period of development. At the critical time of blossoming, monthly mean temperatures, somewhere around 70 deg. F., seem to be favourable to the plant. Ripening and harvesting of the seed may follow in a month or period that is either warmer or cooler than the blossoming time. Good seed yields have been obtained, and are constantly realized, in either case.

Moisture Conditions.

One may normally expect satisfactory seed yields in such localities where the soil moisture is sufficient for a strong development of the first crop, and where low rail fall prevails during the seed setting of the second crop. With alfalfa, as for instance with strawberries, we want a well developed root system, which will provide the necessary physical vigour to the plants which have to produce the subsequent seed crop.

We also need sufficient reserve moisture, so that the second crop may be able to push ahead immediately the first crop has been removed. But we do not want excessive rain during the blossoming period, because moisture in abundance at that time tends to promote vegetative growth rather than to favour blossoming and fruit setting. Under irrigation conditions, where it is possible to regulate the moisture satisfactorily, we have consequently an ideal situation as far as this factor is concerned. Excessive rain or excessive irrigation, after the seed has set, promotes the growth of new shoots, which affect the seed yield in an unfavorable direction.

This, of course, does not mean that rain might not be desirable for the second crop under any condition, or that irrigation water should never be applied after the seed has set. Where the ground is very dry, the plants will naturally benefit from a moderate rain fall or from a suitable application of water.

Sunshine.

For seed setting a maximum amount of sunshine does not appear to be the best. It is naturally difficult to estimate exactly what amount should be considered as optimum—and it would be still more difficult to regulate the quantity. From a study of meteorological data for districts and years noted for a high production of alfalfa seed, it would seem that an average cloudiness of 30-35 per cent would be desirable. Interpreted in sunshine-hours this means that our B. C. averages of around 300 hours of bright sunshine in the months of July and August are quite satisfactory. Someone might perhaps feel inclined to deduce from this statement that direct shading or dense growth, which would partly amount to the same thing, might be favourable under very bright weather conditions. Such, however, is not the case. In crowded stands, as with unpruned and much shaded fruit trees, the best flowering and fruiting, that is seed setting, take place only on the outer and upper branches where pollenation fertilization, development and ripening are more certain to be affected in a favourable direction than where shade or half shade prevail. This is the reason why planting of alfalfa in rows has given so much better seed returns than the broad-casting method. Planting in rows also facilitates irrigation and subsequent cultivation.

Tripping and Fertilization.

The tripping or releasing of the trigger mechanism, which controls the fertilizing organ, is due to a touch or a movement by wind, pelting rain or visiting insects. Bees are evidently the most aggressive, if not the most important agents in opening the flowers and scattering the pollen. They, as we all know, are always less active during damp rainy weather than they are on dry sunny days. On the other hand, if the alfalfa plant is undergoing heavy transpiration, on account of excessive dry and hot weather or wind, the trigger mechanisms of the flowers operate more tardily, and a smaller number of pistils and stamina are released.

If the flower dries up and remains on the stem we may be certain that fertilization has taken place, whereas dropping flowers are an indication of failing fertilization. Thus we may judge at a comparatively early stage whether the seed has set or not, and can act accordingly.

Time Required for Maturity.

Speaking generally the seed crop requires about twice the time needed by a hay crop, or somewhere around 80 days. Early cutting of the first crop, for hay, soiling or silage, is therefore necessary in order that the seed crop may have time to develop in a propitious season. Supposing the first crop is cut about June 15th, the plants will be in full bloom by July 30th, and the seed should normally be mature by about September 5th, and should thus escape killing frosts in favourable localities.

Economy.

Can we afford to grow alfalfa seed in B. C.? The answer to that question depends of course on the price of land, the yield of seed, and on the price of the seed that we produce. The average yield for all seed producing states to the south of the line is 3.5 bus., or 210 lbs. per acre. A wholesale price of 25c per pound would then secure us $52.50 in addition to the value of the first hay crop. From this sum, whatever it be, rent, interest and labour must be deducted. Like most

farming enterprises, it is consequently not a "get-rich-quick" scheme. Nevertheless, there are undoubtedly conditions under which seed production would be a paying proposition in B. C.

Conclusion.

It is understood, the writer presumes, that nobody suspects him of being of the opinion that alfalfa seed cannot be produced under conditions other than those just outlined. But it should be understood also, that alfalfa is a plant which is very particular in its requirements.

Applying the previous discussion to British Columbia we find that the area naturally suited to alfalfa seed production is rather limited.

As far as temperature is concerned, all such districts are out of the question which suffer constantly from late or early frosts. We have apparently no districts with *absolute* optimum temperature for flowering, although the Lillooet, Ashcroft, Kamloops, Okanagan, Similkameen, and some of the Kootenay districts approach it quite closely. In most of these locations irrigation will be required so that moisture may be supplied at right times and in suitable quantities. There is no denying the fact that early fall frosts may constitute a danger, in certain years, to the ripening of the seed. In such years it is safer to cut the seed a little early, rather than wait for complete maturity of all the seed.

These statements are not intended to be discouraging, but are made in order that we may be quite clear in regard to the requirements of the alfalfa plant in these respects. The seed crop, and by that I understand a paying yield, is very exacting, from the spring growth, through summer development, and to autumn harvest. As one observer has remarked, "the crop is never assured until the plants are loaded with clusters of well filled pods." It is well worth while to remember also, that even after the seed is in the bags, the success of the season cannot be fully realized until the effect of the weather on the seed crop in other localities is known.

Plows and Plowing

By J. MACGREGOR SMITH
Professor of Agricultural Engineering, University of Alberta, Edmonton.

NOTE: (The author of this article realizes that the information it contains covers the subject in a very brief manner. He has tried to make it essentially practical. More questions have come in for solution on the subject of plows, and especially on the draft of plows, than on any other one branch of Agricultural Engineering. Information along similar lines to that which is contained here, should be brought to the attention of every Agricultural College student at some time in his college course.)

"Why plow; when to plow; how to plow; are three questions of vital interest to the tillers of the soil. During the past two hundred years plows and plowing have been discussed by a thousand brainy farmers, who knew the art from actual experience between the plow handles, and by 10,000 others, whose only experience was watching a sturdy farmer turn the soil while they rested under a shade tree."

The above quotation hits the nail on the head. "Having been there," the writer realizes that there are many difficulties connected with this—our most important tillage operation. Do you realize that a plow is harder to run right than a binder? Do you realize that plowing takes more power than any other tillage operation? Do you realize that many settlers in Western Canada are plowing under entirely different conditions from those that they were used to "down East", in the Old Country", or " in our country", as our friends from the South so often say?

While the subject has been discussed until it is almost thread-bare and shiny, yet by getting together in a systematic manner, and discussing some points, connected with the operation of the implement rather than the work it does, we may be able to help each other.

Whether you agree with the foregoing remarks or not matters little; one thing you have to admit is that there is far too much very poor plowing being done in Western Canada. The splendid annual Provincial Plowing Match, held in Ontario, is also evidence that the importance of good plowing is fully recognized and encouraged there. Now since the amount of time required for a good or a poor job in this case is practically the same, let us decide to have none but the best. It is only good business.

The Pulverizing Action of a Plow.

We break with a long sloping moldboard. Why? Because we simply want to turn the furrow slice upside down so that the sod will rot. We plow stubble land with a quick turn or steep moldboard. Why? Because we want to get the land into a good physical condition; in other words we want to pulverize the soil. (See Fig. 1.) Take a book and hold one corner between your finger and thumb, then by allowing the leaves to slide over one another you will readily see what happens to the furrow slice as it passes up over the moldboard of a stubble plow. There is a shearing action. Imagine a pin in the position 3-3 and notice how it has been sheared into many parts as it reaches the position 1-1. The steeper the moldboard, the greater the pulv-

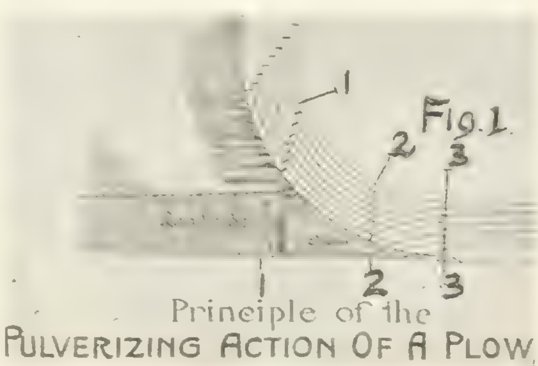

Figure 1.

erizing action. When the soil is very wet, as it often is in the Spring, or very dry as it often is in the Fall, we do not get this finely pulverized condition. There is an ideal condition and in summer following we usually get good results as the soil is neither too wet nor too dry. Perhaps you never realized that a plow had a pulverizing action on the soil at all. We want an even top so that the least possible surface will be exposed to the drying influence of the sun and wind. When the land is ridged it will dry out quicker, because more surface is exposed. We do not want high crowns and deep dead furrows as we had in Ontario, or perhaps, in Scotland, because we have no surface water to get rid of.

The Strike Out.

A fad, you say. Oh, no. You say you have no time. Then I say you are a poor business man. It only means one round more and you get all the weeds and we need to get them and get them young. As one clear. At a plowing match for example, stakes (which are numbered) are placed at each end of the field. The round dots indicate the feering poles which are set up as desired, to get a straight strike out. There is another method of striking out, but if every farmer would see that his lands are opened up as shown, it would be a long step toward better farming methods.

Unmatched Furrows.

Sometimes called "paired furrows," "uneven furrow backs." In other words a shallow furrow and a deeper furrow in pairs. By considering some of the causes of this very common fault we will now proceed to discuss some practical difficulties which experts have to deal with every day. We will take them in the following order:

1. Front plow cutting too wide.
2. Plows not cutting the same depth.
3. Colters not properly set.
4. Bail support moved.

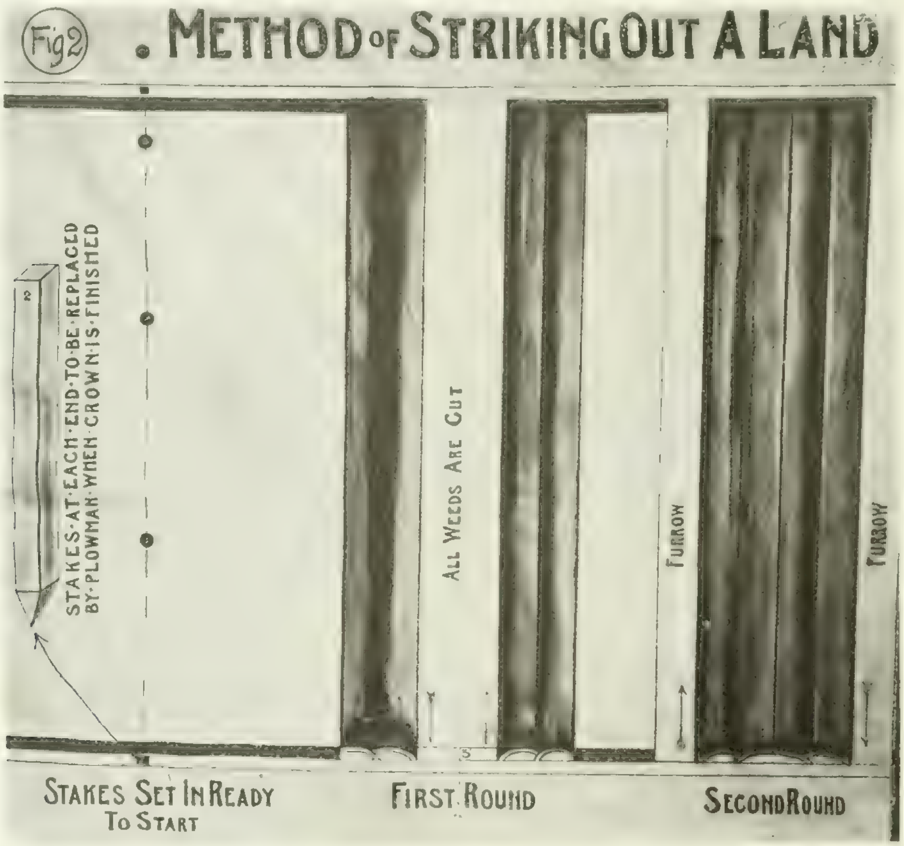

Figure 2

passes along a road in the middle of winter, on every side there are long rows, very often "crooked as a dog's hind leg", of weeds, indicating that the man had simply driven into the field and let the plow rip any old way. The result—half a day has to be spent finishing up "ends". You know what I mean. (See Fig. 2). Suppose you wish to plow 5 inches deep, then after setting up your stakes you proceed to throw out two furrows about 3 inches deep. "Haw" around and throw out other two furrows. You then have what looks like a shallow finish. Now "Gee" round and throw back the furrows and keep on gethering up the land, gradually increasing the depth. By the time you have reached the third round you should be down to the desired depth. All the weeds are cut and you have a level crown. The illustration will make the point

5. Sprung beams.
6. Hitch not right—side draft.

Front Plow Cutting Too Wide.

In this enlightened age would you believe that a man would be content to sit on a bag of hay for 10 hours a day and see his 14-inch two-furrow gang plow cut 38 inches? The writer saw it. The man had not time to visit a "Better Farming Train", which was visiting his town and was actually at the time within a stone's throw. He knew it all. The weeds were four feet high, the moisture had been all evaporated and "cut and cover" would have been a better name for the operation than plowing. (See Fig. 3.)

Wear at the points XX will allow some play between the front vertical axle and the sleeve casting which supports it. It is an advantage to have a long bearing

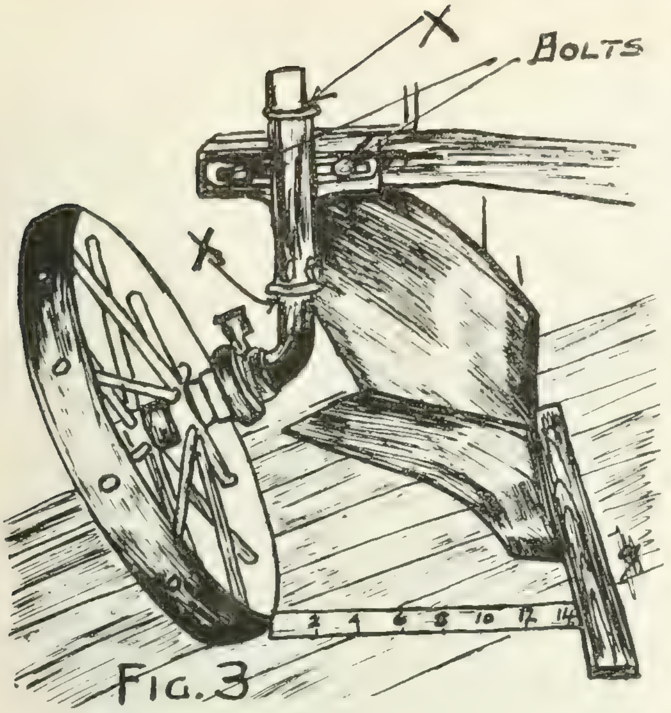

Figure 3.

surface at this point. The result is that the front plow tends to take more "land". The trouble in the above extreme case was that the bolts holding this casting to the frame were both loose. A monkey wrench fixed the plow in two minutes. The plow was all right; was the man behind it all right? Lay a straight edge along the landside and measure 14 inches over as shown; some advocate 13½ inches, and this will depend on the "set" of the implement at work. The set of the colter and the hitch will be dealt with in their proper place.

Plows Not Cutting the Same Depth.

The farmer should very carefully measure the "suction" of the plow when new. It has "suction" under the landside and also on the side, to give penetration and "land". A straight edge and a rule are all that are required to get this information. (See Fig. 6A.) You should scratch the measurements down on the shop door, or in a note book or in your head. The manufacturer gives his particular plow a definite "set" and this "set" must be maintained if the best results are desired. You will know if the village blacksmith has given the share more or less, if you have the figures; some think that an eighth of an inch more or less "suck" makes no difference; it does, and usually too much is given, and it may take 50 per cent. more power to pull the plow. The team have the heavy

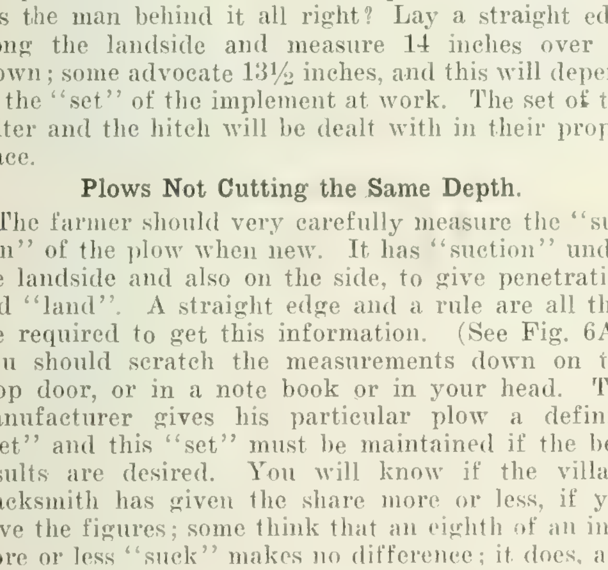

Figure 4.

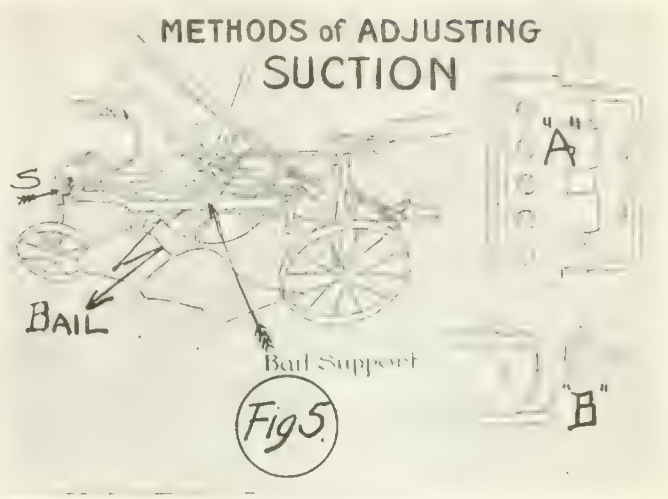

Figure 5.

end to bear; if the plow was an old walking plow you would very soon find out something was wrong and have it fixed. Do not be too hasty in condemning the plow. You or the blacksmith may be to blame. The "suction" can be altered on some plows at the point marked "s" by raising the frame on the rear axles. (See Fig. 5.) The two cuts (5A and 5B) on the right

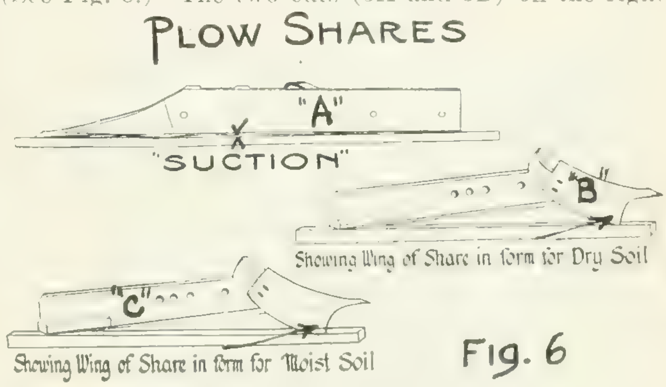

Figure 6.

hand side of the same illustration show how suction is adjusted in engine plows. However, this should be a last resort. A walking plow is given "bearing" at the wing of the share, more in moist soil than in hard, dry soil. This is required to hold the plow level and prevent it "winging" over. A gang plow share does not require any because the bottom is held up by the bails (the U-shaped bars on which the beams swing). Turn the plow up and lay a straight edge from the heel of the landside to the wing of the share. Figure 6 "A" shows "suction" on bottom of landside. Figure 4 "A" shows suction to the land. Figure 6 "C" shows a share suitable for moist, soft soil. Figure 6 "B" shows a share in form for hard, dry soil or a gang plow. Figure 6 "D" shows a share that would do well for an average gang plow. You can readily see that, if by mistake a shipper sends you one of each kind when you order a new set for your plow, one furrow will be deeper than the other and the source of trouble

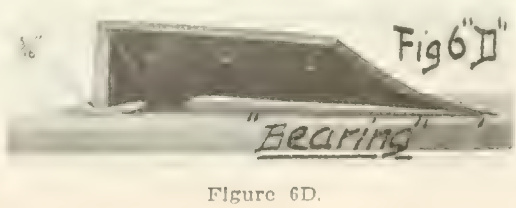

Figure 6D.

has puzzled even the best plowmen; perhaps you may have had this experience. In a gang plow the friction on the bottom of the landside is eliminated as far as possible by carrying it on well-oiled bearings. There should be from 3/16″ to ½″ at the point marked "D" figure 4, and also in Figure 6 "D". The rear furrow wheel is also set outside the lien of the landside as shown at "C" in Figure 6. This holds the landside away from the furrow wall to some extent and a small adjustment at this point will give more pressure to the moldboard and the plow will often scour better. Figure 7 shows two methods of adjusting the rear furrow wheel. In some cases two set screws are used for making this adjustment, while some plows have two slotted holes, so that the wheel can be moved one way or the other. See that there are spring washers at every bolt, or else have a hot rivetted frame wherever it is possible. A loose frame will cause no end of trouble.

Keep the Plow Frame as Level as Possible.

Figure 5 shows a bail support — a small iron clip found in different places in different makes of plows. If it gets moved even an inch ahead or back it will do what? It will allow one plow to go too deep or prevent one going in deep enough. Experts have travelled 40 miles from a railroad just to move this little piece of metal one inch. These things are simple, if you know they are the cause of the trouble, but they puzzle the best, if their purpose is not understood.

Every instructor in every course in Farm Machinery in Canada should emphasize the important adjustments that are found on a modern gang plow. The results would be far reaching and much better plowing would result. Let me quote a very typical case:

"At the recent National Tractor Show at Columbus we heard a story that emphasizes again the necessity of knowing every feature of a machine.

A prominent concern manufacturing tractor plows had received numerous complaints that its plows were falling down in a certain section of Iowa, the principal trouble being share breakage. This was hurting business and at the same time one of the company's keenest competitors was increasing its trade. So a plow expert of thirty years' experience was sent to the "battle ground" to scout around and ascertain the trouble.

In a short time the expert returned, but he could give no reason for the share breakage, which seemed to be about the only trouble, except that the section was stony and the stones broke the shares on his plows but did not on the competitor's.

One of the head men of the company happened to listen to his report and forthwith took the expert over to one of the plows.

"Was that bolt in place?" asked the executive, pointing to the device that locks the bottoms rigid in the soil, "or were you floating the bottoms?"

"Sure, the plows were set up all right," replied the expert, "nothing was missing."

"Don't you know, you blamed idiot," rejoined the executive, "that you should remove that bolt in stony ground so that the bottoms can float and have several inches play? Did you suppose we designed this plow to meet just such adverse conditions only to have it fall down because our own salesmen and experts don't know the ABC of its adjustment? You'll attend our plow school for the next two weeks."

Upon hearing this story we thought it would be interesting to find out whether the representatives of plow companies at the show were following out the educational spirit of the event, so we called at one of the largest manufacturer's booths in company with a power farming distributor and looked for the locking-down device. A salesman approached and asked if he could show us anything.

"Sure," we said, "where is the adjustment for floating the bottoms when you're working on stony ground?"

He looked pained for an instant; then a look of relief spread over his face and he said:

"Why the bottoms are always floating against this spring (pointing to the lifting spring), they never are locked rigid."

We thanked him for the "information" and then sought out a man with the company who we knew was posted on plows, plowing and everything concerned therewith.

"How about it?" we said. "One of your men says that your plows can't be locked down, but always float against the lifting spring."

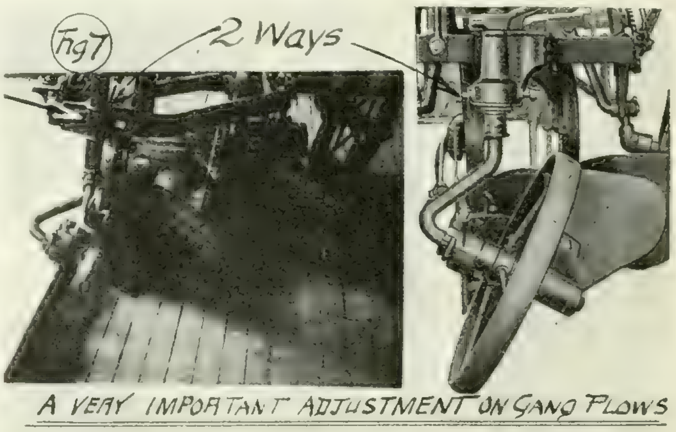

Figure 7.

His only reply was a snort, and leading us over to the plow, pointed out the adjustment.

Figures 7 A and B show the two adjustments which were confused. The adjustment, the set screw, to make a plow "float" is not understood as well as it ought to be.

How often have the above and similar simple adjustments caused unnecessary trouble, and expense from breakages?

We will now pass on to the colters.

Colters Not Properly Set.

The importance of the proper set of this attachment cannot be over-estimated. It must be set just right to obtain the best results.

1. Usually the bearing of a colter is set between a point directly over the point of the share and another point about three inches behind it.

2. For plowing down trash or manure so as to give the plow plenty of "clearance" (see Fig. 4 "B").

3. For stony ground it is advisable to set it well ahead and down so that in the event of a plow striking a stone, the tendency will be to raise the plow out of the ground and thus save the point of the share.

4. For stubble plowing the colter should be set about one-half inch outside the line of the landside, and down low enough to cut about one-third of the depth of the furrow slice.

5. In sod run the colter closer to the shin and also down almost to the bottom of the furrow.

6. Sometimes by setting the colter a little "wide" the scouring of the plow is improved.

7. When a badly worn bearing causes the colter to wobble, get it fixed, because it will increase the draft besides doing inferior work. Take as good care of your colter as you do of your shares.

Types of Colters.

There are four common types namely, the fin, knife, rolling, and skim colter (commonly called a jointer). In good scouring soil that is free from stones, the combined rolling colter and jointer gives splendid satisfaction in covering weeds.

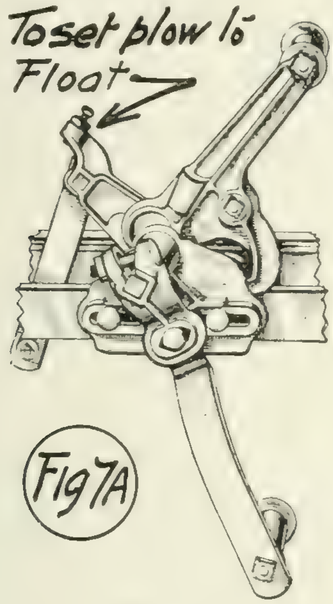

Figure 7A

Jointers are used to cut and turn over the edge of the furrows close to the colter so that when the slice is turned over, all surface growth will be completely buried. It simply turns over a small furrow, which lies on top of the furrow slice. This is turned over by the moldboard, the result being a clear edge between the furrows and no weeds visible. The jointer should be set with its point directly below the hub of the colter and so as to cut not more than two inches deep. The point should be set very close to colter, but a small clearance should be allowed between jointer and colter. This clearance prevents the jointer from catching and retaining trash.

Figure 8 shows a typical combined rolling colter and jointer. So many people have asked if the jointer is to clean the colter that the writer takes this opportunity of saying it is not for this purpose.

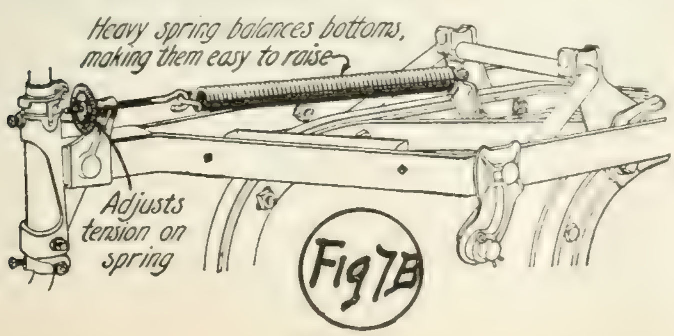

Figure 7B.

Figure 9 shows a jointer and rolling colter attached to the beam independently. Notice the chain for covering the weeds as well as the device for keeping the colter clean.

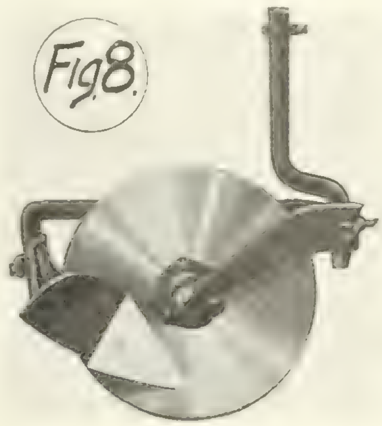

Figure 8.

Bail Support Moved.

This trouble was dealt with under the heading "Plows not cutting same depth." Again let me call your attention to this very small but very important part of your plow.

Figure 9.

Sprung Beam.

Many wrong adjustments on a plow are attributed to a "sprung beam." If you had measured the distance the beams were from the share and the distance they were apart when you purchased the plow you would be in a better position to judge this point correctly. Beams are sprung often in stony ground. It is very questionable whether they can be fixed locally or not. It will depend on the quality of the steel and the skill of the blacksmith. My advice is to buy a new beam.

(To be continued.)

Mineral Feeds for Farm Animals

By J. SOTOLA, Animal Nutrition Department of
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INTRODUCTION.

Among the numerous problems of animal nutrition those bearing upon mineral metabolism are assuming an interesting aspect. Comparatively recent developments in the field, especially in connection with the dairy cow and the hog, have tended to stress the importance of mineral matter in the rations of these animals.

The requirements for minerals are secondary to the larger needs for protein and energy, but higher standards in animal production as evidenced by the increasing numbers of pure bred livestock, and keener competition in the methods of feeding have magnified the imporance of all points which tend toward greater economy of production.

It has been shown that the mineral content of soils affects more or less directly the mineral content of the grains and roughages produced on such soils. Animals with ricketv symptoms have been identified with sections where soils are infertile, where the calcium and phosphorus content of the soils is especially low. In such regions devitalization, sterility and complication at time of parturition have been traced to lack of minerals, especially to that of calcium and phosphorus.

The material here presented is treated under two general sub-heads. Part I, *Mineral Metabolism*, deals with the conversion of minerals in feeding stuffs into body substances, with a general review of the functions of mineral elements in the animal economy. Part II, *How to Feed Minerals to Livestock*, is treated with the view of pointing out some of the practical applications of this subject.

PART I.

Mineral Metabolism.

Method of Assimilation.—The various elements as Sodium, Potassium, Calcium, Magnesium, Iron, Sulfur, Phosphorus and Chlorine enter the body in organic and inorganic form. In digestion numerous reactions occur.

Calcium salts as calcium lactate, reacting with Na_2CO_3 of juices poured into intestine or with K soaps from digestion of fats, would be precipitated in insoluble form.

Similarly Iron salts may react with H_2S (a product of putrefaction of proteins) to form insoluble iron sulfids.

In protein digestion inorganic radicles or complexes may or may not be liberated.

(1) Calcium caseinate of milk would yield Calcium and H_3PO_4 on complete digestion.

(2) Phosphoric acid of nucleo proteins would also be liberated. On the other hand the iron of hemoglobin would probably not be split off from hematin.

Food phospho-lipins are partly split in the digestive tract, giving rise to glycero-phosphoric acid—but probably no free phosphoric acid.

Sulfur ingested is mostly combined in the unoxidized form in proteins of the feeds—only small amounts of sulfates occuring as inorganic salts. Sulfur is absorbed as such in the mercapto group of cystine, (a derivative of propionic acid). Some of the sulfur, however, is lost as metallic sulfids.

Theory of Bergheim:—Insoluble mineral salts in intestine—as $Ca_3 (Po_4)_2$ may be dissolved and absorbed through the agency of many leucocytes which are known to migrate into the intestinal lumen during digestion. The leucocytes are rich in nucleic acid, and other phosphoric acid compounds — and it is suggested that through the action of enzymes (phospho nucleases), phosphoric acid is liberated from them—which form soluble acid phosphates of the insoluble $Ca_3(PO_4)_2$. The calcium gains access to the body in combination in the leucocyte.

Functions of Mineral Elements

(A) They are constituents of tissues and fluids.

(B) In osseous tissue phosphates and carbonates of Ca and Mg give rigidity.

(C) Na_2HPO_4 and Na_2CO_3—transport CO_2 from tissue to lungs.

(D) Iron containing hemoglobim of erythrocytes supplies tissue with oxygen.

(E) Ca of blood is essential to blood coagulation.

(F) Hooker has shown that Ca produces contraction of the muscular coat. Potassium and Sodium cause relaxation.

(G) If the salt content of blood is changed—there is an effect on heart action. Potassium salts slow up heart and may stop it, (in condition of diastole). If heart is perfused with fluid containing no calcium, muscular contraction is impossible. Abnormal amounts of Ca may stop heart in condition of systoe. Sodium ions in blood are essential to heart action. Their absence destroys contractibility and irritability. Sodium salts in physiological salt concentrations produce relaxation of heart muscles.

The above illustrations tend to emphasize antagonism of Ca ions vs Na and K ions. The first favors contraction, the latter relaxation.

(H) Transmission of nervous impulses and transference of impulses from nerve to muscle are dependent on the presence of inorganic ions.

(I) Mineral substances play a rôle in digestive juices. They provide suitable H ions and OH ion concentration for optimum functioning of enzymes.

The endocellular enzymes—to which are due many chemical transformations of cellular metabolism would probably be inactive in the absence of electrolytes.

(J) Inorganic salts preserve and regulate proper osmotic pressure of body fluids. NaCl is particularly concerned in this function. Inorganic salts are concerned in the movement of liquids and dissolved substances into or out of cells—because of their capacity of modifying the permeability of the cell or cell membrane.

Example:—If Sodium iodide is injected intravenously into dogs, fluid is exuded into the pleura and edema of lungs results. If Ca Cl_2 is injected simultaneously, no exudation occurs and the pleural cavity remains dry. The Ca salts appear to decrease the permeability of blood vessels by increasing consistency of colloids of cells comprising walls of the vessels.

In general Ca possesses the property of increasing the rigidity or viscosity of colloidal systems.

The importance of iron in the body is entirely out of proportion to the small amounts of iron contained in tissues and fluids.

A man weighing 60-70 kgs—contains approximately about 3 grams of iron, 80 percent of which exists as a constituent of hemoglobin. The rest of it is in the

chromatin of cell mulein in combination with nucleoproteins.

There are good reasons for believing that iron compounds of the cell act as catalysts to the oxidizing enzymes.

Iron compounds besides furnishing iron for the synthesis of hemoglobin appear to exert a stimulating effect on the production of hemoglobin—(Hense the value of medicinal iron compounds in anemia).

The mineral elements are intimately involved in the maintenance of the acid-base quilibrium of the body. In the opinion of many this function is one of greatest importance and is considered one of the determining factors in proper balancing of rations of farm animals.

Their Metabolism.

Higher mammals contain from 2 to 5 percent of ash, about 3/4 of which is contained in the skeleton. The mineral requirement of the animal organism, especially of growing or pregnant animals, is largely determined by the composition of the skeleton.

In bone, mineral matter is deposited almost entirely in inorganic combinations. Growing or pregnant animals require relatively large amounts of calcium and phosphorus, which may be supplied to them in inorganic form.

Small portion of the mineral elements absorbed from the intestines is built up into complex organic compounds.

In the case of lactating animals, considerable quantities of calcium may be combined with casein and with lactic acid produced in the mammary gland and excreted in the milk as calcium caseinate and lactate.

Much of the mineral material ingested with the food is in excess of the body's requirements and is promptly excreted—almost entirely as inorganic salts. If absorbed in organic combination, the organic radicle is generally oxidized and the inorganic ions combined with other ions to form salts previous to elimination from body.

The method of excretion of mineral elements from the body depends largely upon the character of the mineral elements.

1. Iron is almost entirely excreted through the intestinal wall and ultimately leaves the body in the feces. The urine rarely contains more than a trace of this element.

2. In herbivora most of the Calcium is excreted in the feces. It is well known that calcium of the feces comes from the body as well as the food.

Elimination through the intestinal wall has been proven for Ca as for iron, and during fasting or undernutrition the principal way in which calcium salts are lost from the body is through the walls in the intestine.

3. The excretion of Mg and P runs more or less closely parallel to that of calcium.

4. Na, K and Cl and S are excreted largely through the urine, this being true especially the last two avions.

In Ohio experiments with pigs (Bulletin 27) it was shown that from 97 to 99 percent of chlorine excretion appeared in the urine.

Also that 54 to 78 percent sulfur excretion,
67 to 87 percent Na excretion,
57 to 83 percent K excretion, occur in the urine.
And only 9 to 20 percent Ca,
10 to 19 percent Mg,
19 to 43 percent P,
excretion occurred in the urine.

In general:—the magnesium of the food is shown to be a factor in the *partition* of phosphorus between urine and feces.

An increased proportion of Mg to P in food increases the proportion of fecal phosphorus to urinary phosphorus.

A high Mg intake seems also to be detrimental to Ca retention. Mendel and Benedict have shown that injection of Mg salts into dogs produced an increased elimination of Ca in the urine.

Hart and Steenbock at the Wisconsin Experiment Station fed a pig a ration of corn, wheat bran and oil meal, and determined the excretion of calcium in urine and feces.

The addition to the day's ration of 6.08 grams of either $MgCl_2$ or $MgSO_4$ caused a marked rise in the excretion of calcium in the urine, with no appreciable effect on the fecal calcium.

A positive calcium balance thus by the addition of Magnesium was converted into a negative balance.

There is no evidence therefore that the limited utilization of calcium by milk producing cows is due to the limited solubility of calcium compounds of the ration.

The fact that heavily milking cows lose calcium at the same time that they receive a readily assimilable supply greatly in excess of the amount utilized, shows that the calcium stores of the body are more readily accessible for use in milk production of the cow.

In comparison with the extent of the change of intake in Forbe's Experiments, it becomes apparent that the mineral metabolism of the well fed, heavily milking cow is not intimately and directly dependent upon the mineral nutrients of the ration during lactation, but that it is determined by (A) the inherited impulse to secrete milk, (B) by the mineral reserve of the animal body, (C) only thirdly by the minerals in food supply.

Value of Organic and Inorganic Compounds of Mineral Elements in Nutrition.

The body requirement for mineral salts is largely inorganic. There is little question that inorganic salts of food can meet the body requirements for mineral elements in inorganic combinations.

It is a question, however, whether the inorganic salts ingested in, or with the food can be built up in the body into organic combinations.

The field of usefulness of inorganic salts would seem to be restricted by the fact that the union between their ions is more stable than that between either ion and the organic complexes with which it might otherwise be combined in metabolism.

For example:—K_3PO_4 is probably not well suited for all the needs of the organism for phosphorus, simply because the potassium has a stronger affinity for the phosphorus, than it does for glycerol, or for the nitrogenous bases with which it might otherwise be combined in the synthesis of phospholipins.

In favor of this explanation is the fact that the nature of the organic compound containing a given mineral element seems to be a matter of indifference as far as its value in nutrition is concerned. Thus casein, nucleic acid, or lecithin can furnish the body with phosphorus in a form suitable to cover all types of phosphorus requirements.

Acid Base Equilibrium.

Temperature and neutrality are physico-chemical conditions vitally connected with the proper working of physiological processes in higher mammals.

In all tissue of the body during life, there occurs a continuous production of acids—final products of metabolism. They are carbonic, sulfuric and phosphoric acids.

They combine immediately, although only partly with the basic constituents of protoplasm, intercellular lymph and blood.

Under conditions of great cellular activity and insufficient oxygen supply, intermediate products of metabolism of an acidic character as lactic acid, may be produced faster than they can be removed by oxidation, and thus claim their share of base.

During fasting, or certain pathological conditions as diabetis, quantities of beta-oxybutyric and aceto acetic acids (representing incomplete oxidation of fatty acids and amino acids), accumulate in the tissues and fluids and combine with their basic constituents. In these ways the processes of normal metabolism steadily operate to lower the alkaline reaction of the body and to diminish its potential alkalinity.

The excretion of NaCl in urine is largely influenced by the water intake. An increased consumption of water flushes out NaCl from the body, while a retention of NaCl results from a diminished water intake.

In steers, phosphorus may be excreted entirely with the feces. In cows during lactation, the urine is generally very poor in salts of all kinds except potassium salts. Apparently the mineral elements which, under other conditions would be excreted in the urine, are diverted to the mammary gland.

The mineral metabolism of a cow fed corn, linseed oil meal, clover hay and corn silage follows. (Figures from Ohio Bul. 295) Milk production was 47 lbs daily).

	Na	K	Ca	Mg	S	Cl	P
Feed	16.87	114.70	51.52	29.47	18.72	24.57	29.27
Milk	7.21	27.92	16.47	2.03	5.16	14.19	14.22
Urine	1.25	68.80	.01	7.31	3.05	.55	.10
Feces	2.03	20.12	49.71	24.09	10.16	8.16	16.78
Balance	+6.39	—2.14	—14.68	—3.95	+0.34	+1.67	—1.84

Most of the ash of such urines consists of K and Na carbonates. The low content of chlorine in urines in spite of the ingestion 28 grams of NaCl per day is noteworthy. In this experiment the cow is drawing upon her skeleton continuously for calcium, magnesium and phosphorus.

Three years work upon the mineral metabolism of the dairy cow lead Forbes of Ohio to conclude:—

(A) Irrespective of large intake of calcium, this element was eliminated in quantities greater than were contained in the feed. There is but slight evidence that the precipitated bone flour or calcium lactate or $CaCl_2$ added to the rations were utilized.

The strain to which the mechanism for maintaining body alkalinity is placed under ordinary conditions is determined by the character of the food which the body is receiving.

If the ration gives rise to equivalent amounts of basic and acidic radicles in metabolism, the body is under no necessity to call into play special mechanisms. If the ration gives rise to excess acidic radicles over basic ones, the kidney must cope with the acid.

If the ration supplies excess basic radicles the excess base appears in the urine as carbonates.

In determining whether a feeding stuff is acidic or basic, in the sense that it will give rise to excess of acidic and basic radicles it is analysed for:—(1) Acid elements, phosphorus, sulfur and chlorine, (2) Basic elements, sodium, potassium, calcium, and magnesium.

It is then determined by calculation the number of cubic centimeters of normal acid per 100 grams of feed to which the acid elements are equivalent, when oxidized to sulfuric, phosphoric and hydrochloric acids, and also the number of cubic centimeters of normal alkali per 100 grams of feed to which the basic elements are equivalent when considered as hydroxide.

The excess of one or more of the other group of elements can be determined by simple subtraction. Such figures for common feeding stuffs are given in Table I.

From such analyses it is evident that cereals and products as a class are distinctly acid feeds when completely metabolized.

Roughages—especially the leguminous hays possess an alkaline ash—and therefore in this respect as in many others are natural supplements to cereal products.

Of the nitrogenous concentrates—linseed oil meal possesses an alkaline ash, while cottonseed meal possesses an acid ash. The ash of milk is alkaline.

The effect of feeding rations containing an excess of acid-forming or base-forming elements on metabolism was illustrated in Wisconsin Experiments. (Research Bul. 36).

A pig fed a ration which had distinct excess of acid-forming over base-forming elements resulted in the urine being distinctly acid and possessing a high content of ammonia.

As alfalfa hay was added to rations, it brought up the proportion of base-forming elements and consequently the urine was much less acid and contained smaller quantities of ammonia.

Rations decidedly high in base-forming elements produced urine of low acidity and of low ammonia content.

When the alkalinity mechanism of the body is placed under heavy loads so that it does not operate efficiently, a condition of acidosis results—in which the potential alkalinity of the body may be dangerously reduced —and even the hydrogen ion concentration of the blood increased appreciably.

In acidosis the CO_2 carrying power of blood is much reduced and if the condition becomes progressively worse, death from asphyxiation may result. A condition of acidosis is detected by the following:

(1) Excessive content of ammonium salts in urine.

(2) Subnormal tension of CO_2 in alveolar air of lungs, resulting in smaller quantities of CO_2 in alveolar air of lungs, from tissue.

PART II,

How to Feed Minerals to Livestock.

The supply of minerals in rations of livestock demands attention for various reasons. Rations are poor in minerals because:

(1) They contain a large proportion of grains which have low mineral content.

(2) They may contain roughages produced on impoverished infertile soil which is low in minerals.

(3) Sometimes commercial feeds are substituted for natural feeds rich in minerals.

The advent of pure bred live stock selected for earliness of maturity and thickness of flesh has increased

TABLE I

Acidity or Alkalinity of the Ash or Feeding Stuffs.* Results expressed in cc. of normal solution per 100 of dry substance.

Feeding stuff	Excess Acid.	Excess Base.
Cereal Products:		
Wheat	13.01	.....
Wheat bran	.....	1.54
Wheat middlings	2.63	.....
Wheat gluten	68.34	.....
Red dog flour	6.07	.....
Corn	9.88	.....
Pearl hominy	2.87	.....
Gluten feed	20.48	.....
Distiller's grains (corn)	40.12	.....
Malt sprouts	20.27	.....
Oats	7.54	.....
Rice	9.77	.....
Roughages:		
Clover hay	.....	104.51
Soy bean hay	.....	143.41
Cow pea hay	.....	199.96
Alfalfa hay	.....	93.15
Timothy hay	.....	25.74
Corn stover	.....	35.90
Blue grass	.....	35.32
Wheat straw	.....	29.56
Leguminous seeds:		
Soy beans	.....	31.24
Cow peas	.....	22.59
Nitrogenous concentrates:		
Linseed oil meal	.....	27.29
Cottonseed oil meal	7.73	.....
Animal products:		
Milk, skim	.....	19.91
Mutton	44.36	.....
Eggs	80.36	.....
Tankage	.....	36.57
Blood, swine	2.42	.....
"Black albumen"	39.09	.....

*(Taken from Ohio Agricultural Exp. Sta. Bul. No. 255.)

the load the skeleton must carry and has shortened the time for its development. This has focused the attention upon the mineral content of rations of farm animals.

The fact that simple inorganic salts of calcium are assimilable by animals has been understood for years. The feeding of mineral feeds to farm animals justifies itself in that it increases strength and denseness of structure of bones; it makes possible the normal development of rapidly-growing animals; and it aids in restoring the drains for ash that lactating animals or females developing the embryo young have upon their skeletons.

The feeding of minerals produces no exactly measurable increase in growth or in milk production. In cases where rations are extremely poor in minerals some additional growth and perhaps some additional milk may result by the addition of mineral supplements.

The rations of farm animals vary, and for this reason the recommending of any one or group of mineral feeds cannot fit all cases. However, in selecting a mineral supplement it is well to consider its cost, availability, assimilability, palatability, and purity.

The necessity for Calcium and phosphorus is of most practical significance. Calcium is found in large amounts in ground limestone, whiting, bone meal, Calcium lactate, $CaCl_2$: both calcium and phosphorus occur in raw rock phosphate, raw bone, steamed bone, precipitated bone and acidulated bone.

There seems to be very little difference as to whether calcium and phosphorus come from the above inorganic compounds or whether they are of organic origin as phosphorized fats or proteins.

The feeding of excessive amounts of the carbonates as ground limestone or precipitated carbonate interferes with digestion by neutralizing the normally acid stomach. Such feeds, however, may be successfully mixed with feeds in desired amounts.

Among phosphates, the bone preparations are much more palatable than rock phosphates, and also more assimilable. Among the bone preparations (raw, steamed, precipitated and acidulated) the steamed bone is most generally useful, because it is most palatable, available, and not much more expensive. Raw bone is difficult to grind fine enough for feeding purposes and has an animal odor of which cows are afraid. Slightly acidulated bone is more readily soluble than steamed bone.

The phosphates besides being more palatable than carbonates may be taken in much greater quantity without disturbing digestion and for this reason are more useful in a self feeder.

Mineral Supplements for Sheep.

Horses are subject to bone unsoundness because their bones are subject to extreme strain. The quality of bones, after eliminating the hereditary factor, is determined in large part by the character of forage, which in turn is affected by the low or high content of available mineral in the soil.

Horses are sensitive to odors and some will eat bone preparations, while others will not. By mixing 2 to 6 ounces of steamed bone flour with feed daily per head in rations of growing horses the quality of bones may be increased. Quality in this instance has special reference to density and tensile strength. This effect is not visible in the living animal. There seems to be justification for the popular belief that certain regions famous alike for fine horses and luxuriant pasture grasses partly owe their pre-eminence in these regards to the calcium and phosphorus content of its soil and of its forage crops.

Mineral Supplements for Sheep.

Sheep are confined to forage more exclusively than other farm animals. The rate of growth and milk production does not cause excessive demands for mineral, and the forage contains sufficient amounts to meet the requirements.

Mineral Feeds for Cattle.

In sections of the State of Washington where soils are deficient in calcium and phosphorus, pathological conditions of bones in cattle occur. A low mineral reserve of cattle seems to be connected with the following points: (1) cows get in calf with greater difficulty after prolonged lactation than earlier in the period, (2) cows bred young tend to remain small permanently, (3) cows without a dry resting period are apt to begin lactation below their normal rate.

To insure against a mineral deficiency, it is well to give animals access to a two to one mixture of steamed bone and salt. According to work at the Ohio Exp. Sta. calves weighing 90 lbs. will eat about a pound of a two

to one mixture of steamed bone and salt per head in 10 days. Heifers weighing 700 lbs. will eat two pounds of the same mixture in two weeks. Cows in milk confined to barns, giving 28 lbs. milk per day have eaten three and three-fourths pounds of the mixture in five days.

Dairy Cows.

For practical purposes cows should receive one to two ounces of salt per head daily. From the practical view point rations which contain no leguminous roughage are apt to be definitely lacking in mineral nutriment. The minerals of the skeleton appear to be more readily available for use in milk secretion than those absorbed from the ration.

The practical results of ash metabolism experiments with dairy cows seem to suggest that the farm land should be kept in a high state of fertility.

The soils should grow legumes, or be brought to do so by the use of commercial fertilizers containing calcium and phosphorus.

The mineral reserve of cattle should be built up by growing young cattle largely on leguminous roughages or on pasture containing an abundance of legumes.

The cow should receive some leguminous roughage during milk production. All dry cows should receive feeds rich in minerals—so that they may have a chance to restore their depleted mineral stores. The use of large proportion of roughage in the ration is both practical and profitable.

Mineral Supplements for Hogs.

The hog suffers from lack of minerals in ration more than any other class of livestock. It has been demonstrated that hogs which receive sufficient amounts of milk, tankage, or leguminous roughage commonly possess fairly strong bone. This is due to the fact that feeds high in protein are generally high in ash. However, heavy individuals, especially females confined to rations of smaller grains while suckling pigs, frequently suffer through fracture of bones and from strain of tendon attachments. Secretion of milk calls for more calcium and phosphorus than the small grains contain.

Pigs on rations of low mineral content develop rickety symptoms, lameness, and paralysis, during rapid growth. The skeleton of the pig seems to be responsive to the character of the ration. Salts including calcium and phosphorus have been mixed with numerous substances to induce pigs to eat them from self-feeders. Of these condimental substances used with minerals are salt, hummus, molasses, tankage, ground apples, charcoal, ginger, anise, fenugreek, fennel, caraway and coriander.

Salt, hummus, charcoal and ground alfalfa do not add much palatability to hog feed. Molasses has a greater value for flavoring purposes than any substance except tankage in the above list.

The amount of mineral supplements that hogs eat from self-feeders varies in accordance with the severity of confinement. Hogs on pasture have little need for mineral supplements. Supplements are needed in winter when cold weather and frozen ground discourage foraging.

The Ohio Station tested the palatability of mineral supplements for hogs. Eight lots of five hogs each were used, the pigs being confined in pens paved with brick. They were late spring pigs, weighing 46 lbs. at the beginning and 161 lbs. at the end of 15 weeks, making an average daily gain of 1·1 lbs. The ration was made up of corn, linseed oil meal and wheat middlings, (proportion 350-50-50 by weight.)

All mineral supplements were mixed with 3 per cent salt. The total consumption of mineral supplements by lots of five pigs during the 15 weeks was bone meal 7·9 lbs., rock phosphate 14 lbs., precipitated calcium carbonate 15·7 lbs., whiting 16·2 lbs., pulverized limestone 23·2 lbs., precipitated bone 25·3 lbs., and special steamed bone 47·8 lbs. The list runs in the degree of palatability of the mineral supplements. Each daily ration contained at least five grams of calcium per day.

The most efficient supplements were those more readily soluble.

Salt is generally provided by adding one-fourth pound of salt to each 100 pound sack of feed. The other mineral requirements may be met by allowing free access to a mixture of equal parts of calcium carbonate and calcium phosphate mixed with 3 per cent salt, added. The mineral supplement may also be mixed with the grain ration in the proportion of one-half to three-fourths lbs. to 100 lbs. grain. Range cattle consumed about 7 lbs. of salt from March to September.

Sows are sometimes supplied with a mixture of charcoal, 12 parts, rock phosphate or lime, 3 parts, salt, 1 part. Feeding of wood ashes, corn cob ashes and charcoal is of decided benefit. Feeding of coal ashes has nothing to recommend it.

Clover and alfalfa hay and pasture grass are useful sources of mineral nutriment for hogs.

Milk and high tankage rations permit the storage of much larger amounts of calcium than do any of the straight grain rations.

Mineral Content of Animals.

Below is a table giving per cent of ash in carcasses of cattle, sheep and hogs.

Cattle, 3·92 p.c. to 4·66 p.c.
Sheep, 2·81 p.c. to 3·17 p.c.
Hogs, 1·65 p.c. to 2·67 p.c.

Calcium and phosphorus oxides comprise 4-5 of the total weight. Fresh bones are 22 per cent minerals. About one-half to one-third of calcium and phosphorus of vegetable food stuffs is utilized by animals. So in computing rations it is necessary to allow for at least two or three times as much of these elements as the animals require in the vital processes.

Mineral Content of Plants.

Leaves of plants are generally rich in ash because mineral substances carried to leaves by sap are left there as moisture evaporates. Seeds and roots are comparatively poor in ash because of storage in them of mineral free carbohydrates, fats and proteins of low mineral content.

Corn and cereal grains are low in calcium.

Potassium is the principal mineral element in the grass plants and roughage of small grains and corn. Leguminous roughage is characterized by very high calcium content. In cereal grains the phosphorus is higher than in roughage of the same species. In milling by-products which contain the outer seed-coats potassium and phosphorus are both much higher than in whole grain.

Winter wheat contains four times as much ash as does patent flour, and wheat bran 12 times as much.

The various preparations of bone and chalk contain more calcium than anything used as food. Some brands of tankage are high in calcium because of the high bone content.

Phosphorus in feeding stuffs is found abundantly in bone preparations, tankage, wheat, grain, cottonseed meal, wheat middlings, rice polish, soy beans, and linseed oil meal.

Some Problems of Fox-Farming*

By J. A. ALLEN, Animal Pathologist, Fox Research Station, Health of Animals Branch.

Introduction: For some years a very interesting biological experiment has been in progress in Prince Edward Island. The valuable black or silver fox, which is a sport of the common red fox, has become a fixed type; and the raising of this animal in captivity is now an established industry, which has spread to other provinces of Canada, United States, Japan, and some European countries.

Although a few foxes háve been kept in confinement in Prince Edward Island for a great number of years, the expansion of fox-farming did not begin until 1909, or thereabouts. Before this time, fox-raising was a secret pursuit in which only a few were allowed to participate. The knowledge that the men already engaged in the enterprise were making handsome profits from the sale of the pelts of foxes which they were raising, gradually leaked out, and a scramble to get possession of foundation stock became a veritable craze.

The practice of pelting ceased about 1911, and all available foxes were sold alive. So great was the demand that the cost of a pair of foxes steadily rose from \$3,000 a pair in 1909 to \$20,000 a pair in 1914. During the hey day of the craze as high as \$35,000 were paid for exceptional specimens. When the supply of foxes for foundation stock became exhausted, foxes were brought from other parts of the country to help to supply the demand; and optimistic investors began speculating in future, and options were taken on unborn pups for future delivery.

Although there were large sums made in these early speculations, needless to say some individuals lost money in the same pursuit; for history repeats itself and the fox craze came to the inevitable toboggan. It would have probably lasted longer only for the European War, which brought a timely end to speculative fox-trading. The war had a stabilizing influence and changed a highly speculative venture, from which the stock promoter got most of the fruits, into a legitimate industry. So far as the fox industry on this continent is concerned, the day of speculation is apparently over, and live foxes are sold for what their pelts would bring, or a little more, because breeders recognise that every pair of foxes sold means a competitor. The market value of a pair of live foxes at present varies from \$500 to \$2,500, according to quality and performance.

Because of the newness of the industry one would expect that fox-farmers would experience some biologic and pathological difficulties in attempting to keep in confinement a wild animal that was accustomed to roam over a wide territory. However these problems are not so great as one would anticipate, and are probably no greater than those experienced in the domestication of other servants of man.

The finished product, showing gradation from dark to light silver pelts

The Problem of Sanitation: It may be stated as an axiom that in nature the fox has not nearly the same chance of fouling the ground, and his associates have not the same chance of coming in contact with his excretions, as when such an animal is penned up with several of his fellows in a small enclosure. This, together with the fact that the fox in captivity is guilty of filthy habits, makes an alarming and difficult problem. There is also a tradition among practical fox ranchers that interference during the period from mating to several weeks after whelping is likely to cause the parents either to miscarry or destroy their young, so that fox kennels are in most cases not cleansed from the beginning of January until nearly the end of April. This means in many cases that the newborn fox is brought forth in a filthy environment, and is exposed to parasitic and other diseases. Needless to say, pure

* Published by permission of Dr. F. Torrance, Veterinary Director-General, and Dr. A. E. Watson, Chief Animal Pathologist.

bred dogs could not be successfully raised in such environment.

Fox ranchers have tried to copy nature. The usual claim is that the fox in nature does not pay attention to the sanitation of his burrow, and that he thrives best when unmolested. Usually it is a good thing to copy nature. Some of the best inventions of the modern world are merely copies of natural processes. But when facilities are lacking, as is the case in raising foxes in confinement, it is sometimes advisable to deviate from natural habits. Modern civilization is merely the sum total of our gradual adoption of artificial conditions. If we had the same habits and lived under identical conditions as our predecessors we could not thrive in our large congested cities. Congestion is abnormal to any animal,—and we must allow for it when it becomes a necessity. In large cities these dangers have been overcome by applying the principals of hygiene, and by making the individual responsible to the whole.

Now it is evident on the face of it that fox-farmers cannot furnish for their foxes all the sanitary conveniences demanded by modern society, but some of the essential requirements can be approached. If the sanitation of fox-ranches is to be improved, fox men must sooner or later begin the education of their animals in captivity in order that they may live more in accordance with the essential requirements of congested civilization.

A prize-winner at the recent International Fox Exhibition.

There are several ways in which the sanitation of fox-ranches could be improved. A ranch on the double-unit plan could be provided, so that one half of the ranch would be in use while the fouled soil of the vacant unit was being thoroughly disinfected and left to be acted upon by the sunlight and air. The chief objection to this plan is the duplication of equipment; but this should not be an obstacle when the value of the silver fox is taken into consideration.

It might be advisable to experiment with impervious flooring of some kind, such as asphalt, so that the runs could be flushed with water and thoroughly disinfected. The disinfection of pens with earth bottoms has its limitations, since the disinfectant substance is quickly absorbed and soon becomes inert.

Fox kennels should be cleansed at frequent intervals throughout the year. This could be accomplished by providing two kennels for each enclosure, and the foxes could be trained to occupy one kennel while the other is being cleansed and disinfected. If this system were carried out weekly throughout the year, the animals would become accustomed to being moved from one to the other and little inconvenience would be caused even during the breeding season.

The Problem of Disease: This problem has naturally a direct bearing on the general problem of Sanitation. Because of the unsanitary methods, a large percentage of young foxes become heavily infested with intestinal parasites. Round worms have been found in pups only two weeks old, and since the young ordinarily do not come out of the kennel until about the fourth week it follows that the chief source of infestation is in these dens. Either the worm eggs are widely disseminated over the dens or else the parents are themselves infested.

The treatment of pups for worms is now universally practiced when they reach the age of three or four weeks. The medication of fox pups at such a tender age is naturally attended with danger, and many of them do not withstand the treatment. If more strict attention were given to the cleanliness of the kennels throughout the year, and the parents treated for intestinal parasites before mating, the young would not be so apt to become infested and treatment could be delayed until weaning time. It has been difficult to get ranchers to understand that worms do not arise spontaneously, but result from the ingestion of worm eggs; and the worms and their eggs are often allowed to remain in the dens and runs after being removed by Anthelmintics. This means of course that the animals soon become reinfested. Too many fox-farmers regard parasitic infestation as a necessary evil.

A large number of foxes have been found to harbor hookworms. Since they are blood suckers, these parasites have a very deleterious effect upon the health and fur of the animal. In experiments performed recently at the Fox Research Station a method of removing these worms has been found, but owing to the tenaciousness of the parasite, the weakened condition of heavily infested hosts, and the potency that a drug must have to be efficient, a mortality of about 10% results from treatment.

Foxes are subject to most of the common sporadic diseases of Canines. Disorders and inflammations of nearly every organ are observed; but foxes, particularly young foxes, are more prone to intestinal disorders. Tumors of various kinds have been taken from foxes of all ages but their occurrence is rather rare.

Distemper of various types has probably caused more destruction of fox-life than any one factor. Although the disease has never become epidemic because ranches are usually well isolated, great havoc has been experienced in ranches in which it has become introduced. Individual owners have lost as much as $30,000 worth of fox-life in a few weeks as the result of this contagious disease.

As in dog distemper, the etiology of the fox type is very obscure. Micro-organisms of several kinds have been isolated in a few outbreaks, but seldom do we find the same germ operative. Serums and vaccines have given a little encouragement in the control of the disease, but sanitation and preventive measures are at present the prime factors in keeping the disease within bounds. Even in this there is much difficulty as in most cases fox ranches are too congested and no provision is made for the isolation of affected animals. Every ranch should be equipped with an isolation hospital in which the sick animals could be kept under observation.

The Problem of Feeding: There is no standardized method of feeding foxes. The methods used and the

foodstuffs entering into the black fox's dietary vary with the individual feeder. Up until recently no work had been attempted to determine the food requirements of foxes in captivity. In many cases no attempt is being made to feed a balanced ration, and when there is an abundant supply of fish the animals are almost entirely fed upon this food, and when meat is plentiful this is fed almost exclusively over a varied period. As a result of this unscientific feeding many cases of malnutrition, such as rickets, develop.

Restricted diets, especially during pregnancy, are probably the primary cause of many of the difficulties attending the bringing forth of vigorous offspring. During the winter season, milk, eggs and cereals are generally withdrawn from the dietary because the animals are fed outdoors and such food freezes rapidly; so that the animals in many cases are restricted to meat, offal, and fish which cannot be considered as a balanced ration, and is certainly very poor in vitamine content.

Vaccinating a silver-black fox.

The Problem of Breeding: In the early days of the industry "a black fox was a black fox", and anything that resembled a black fox found a ready market. This means that some inferior strains were introduced and their influence is being felt today. In these pioneer days there was much trickery practiced by unscrupulous traders, and the unwary was often deceived. Black foxes in which the type was not yet fixed were sold as standard bred, and the purchaser was not disillusioned until the following mating season when he would be presented with a litter of red or patch foxes.

A story is told of an Indian trapper who brought to the village a very fine black pelt which he desired to sell. Several unsophisticated prospects were anxious to secure the skin, but did not want to appear so lest the Indian would demand its market value. When asked where he had secured the skin, the old trapper replied: "died". Naturally, the men who were negotiating the purchase interpreted this reply to mean that the black fox died during or after the process of trapping. The pelt was bought at a figure much below the market value of black fox pelts, and the owner subsequently found out that the Indian in his laconic fashion had really told the truth. The skin was from a red fox that had been "dyed" black.

So far no universal system has been devised of keeping records that would show the effect of breeding and inheritance. The representative ranches do keep records of performance and much benefit is derived therefrom. The chief breeding points sought are naturally texture, colour, length of fur, fertility and fecundity; and the usual criterion is the price brought for the skins of ancestors or offspring.

Up until recently fox-ranchers have been working in the dark so far as breeding to type is concerned. One breeder had no idea as to what was regarded by another breeder as a good type. The tendency now is to standardize type, and eliminate undesirable traits and fur characteristics.

Fox-breeders have some difficulty in arriving at any general agreement as to whether the silver or the black phase should be emphasized. Some maintain that the dark silver fox,—a fox showing not more than 10% silver,—is too easily imitated by the furrier to retain its exclusiveness, while it is impossible to imitate the more silvery varieties because of the unique colour structure of the hairs. The sponsors of the dark black fox claim that its fur is of superior lustre and texture. Since this is a controversial question, the writer refrains from expressing any definite opinion other than that the supporters of both claims might find it advantageous to come together and cross their blacks with their silvers.

In November, 1920, the first International Live Fox Exhibition was held in Montreal. The holding of such a show marked a distinct epoch in animal husbandry, and gave tangible evidence that the fox is henceforth to be considered in the list of our domesticated animals. The information obtained through competition in this and like exhibitions will go a long way in standardizing fox-breeding, and fox-farmers have now a clearer conception of a distinct type of breeding animal.

In the early days of the industry much difficulty was experienced in getting animals less than two years old to mate, but now many yearlings are mated. In our opinion, there is great objection to this early mating because it is questionable whether the young pups can withstand the physiological drain consequent to the bringing forth of offspring. It would be a much safer practice to postpone mating until the animals were at least two years old.

The Interior of a Fox Ranch.

No system of breeding is complete, and good results can not be obtained, unless accurate record is kept of the performance of the individual. The Fox Breeders Association has for some years kept a register for stand-

ard bred black foxes, but all breeders have not taken advantage of the system. The work of registration has now been taken over by the Canadian National Live Stock Records, so that in future the domesticated black fox will be recorded just like pure-bred horses, cattle, sheep, etc.

The qualifications for registration are as follows: (a) Any silver fox bred and held in captivity in Canada prior to June 1st, 1915, shall on passing inspection by an officer of the Dominion Department of Agriculture, be eligible for registration as foundation stock, provided it has sired or produced a litter or litters which have in no case shown any red or rust, provided also that each parent was a true silver fox and that at least one of them was a ranch bred fox whose parents were both silvers.

(b) Any silver fox born in captivity after 1915 shall on passing inspection by an officer of the Live Stock Branch of the Dominion Department of Agriculture be eligible for registration, provided it is proven to the satisfaction of the Board on appeals and applications to be a full brother or sister of a fox the result of mating prior to June 1st, 1915, registered as foundation stock under rule (a).

(c). Any silver fox shall on passing inspection by an inspector of this Association be eligible for registry whose ancestors for four generations were true silver and whose sire or dam in each mating is a registered fox, providing that either the sire or the dam in each mating in the second, third and fourth generations is a registered fox, and that for the four generations all members in both the direct and collateral lines are true silvers. This rule is applicable only to foxes for which applications for registration shall have been passed on and accepted previous to the thirtieth day of September.

(d). Any silver fox whose sire and dam are recorded shall be eligible to registry on passing inspection by an inspector of this association.

(e). Any silver fox registered in the standard class in the Record Book of the Silver Black Fox Breeders Association of Prince Edward Island, prior to the first day of May, A.D. 1920, shall on passing inspection by an officer of the Live Stock Branch of the Dominion Department of Agriculture be accepted for registry by the Canadian Silver Fox Breeders Association as foundation stock provided such fox bears the official mark of the said Silver Black Fox Breeders Association of Prince Edward Island.

(f). Any ranch bred silver fox born in Canada previous to 1920, whose ancestors for four generations were true ranch bred silver foxes born in Canada and that for four generations all members in both the direct and collateral lines were true silvers shall, on passing inspection by an officer of the Dominion Department of Agriculture be eligible for registration as foundation stock under rules "a" and "e".

(h). No fox shall be described as "silver" whose coat shows red or rusty hairs.

The Fox Research Station was established at Charlottetown, P.E.I., in 1920 for the purpose of studying some of the problems outlined in this paper. The work is under the supervision of Dr. F. Torrance and Dr. A. E. Watson, and the writer is in charge of the experimental details.

My thanks are due to Mr. Chester McLure, Mr. B. Graham Rogers, Mr. P. A. Farquharson, and Mr. Peter Clarke for permission to publish the attached photographs.

CANADIAN SOCIETY OF TECHNICAL AGRICULTURISTS.

First Annual Convention—June 15, 16 and 17, 1921, Winnipeg, Manitoba.

TENTATIVE PROGRAMME.

Wednesday, June 15th.

9·00 A.M. Registration of delegates and members.
10·00 " Address of retiring President.
10·30 " Report of General Secretary-Treasurer.
11·15 " Ratification of election of named officers and other members of Dominion Executive.
11·30 " Appointment of Committees on Resolutions, Nominations, Finance, Constitution and By-laws, etc.
1·00 P.M. Luncheon and welcome by Mayor of Winnipeg and Minister of Agriculture for Manitoba.
2·30 " Business session.
Selection of place for next convention.
Appointment of Auditors.
Amendments to constitution and by-laws.
Reports of Provincial Committees.
Reports of standing committees, etc.
6·30 " Dinner and addresses by Pres. John Bracken and Deputy Minister of Agriculture for Manitoba.
8·00 " Agricultural Research, facilities for work, etc.
Dr. J. M. Swaine, Entomological Branch, Ottawa. (Discussion).
9·00 " The C. S. T. A. and Scientific Agriculture.
J. J. Harpell, Pres. and Managing Director, Industrial & Educational Pub. Co. (Discussion).

Thursday, June 16th.

9·30 A.M. Left over business.
10.00 " Report of committees on Finance and Nominations. (Discussion).
11·30 " Establishment of Bureau of Information. (Discussion).
1·00 P.M. Luncheon and address by Lieut.-Governor of Manitoba.
2·30 " Motor tour of city and visit to Man. Agr. College.
8.00 " Symposium on Agricultural Policies. Leaders in discussion to be arranged.

Friday, June 17th.

9·30 A.M. Business session.
Reports of convention committees.
Editorial Board—personnel, duties, etc.
Statement of Auditors.
Appointment of new committees, other than standing committees.
Fellowships and Honorary memberships.
Representation at Convention of American Association for the Advancement of Science, to be held at Toronto, Dec. 29th, 1921.
Unfinished business.

Afternoon and evening programme for June 17th to be arranged.

THE NEW SHOW IN SCOTLAND.

To Animal Husbandry men and perhaps others who have to do with Canadian exhibitions, a recent event in Scotland, "The Royal Ayrshire Show," popularly known as "The New Show," presents some food for thought. Shows, exhibitions and expositions as they are variously called have ever claimed the credit of being great developing agencies. Education, demonstration, inspiration, etc., have always crowned them in luncheon speeches and press reports. Their power and their benefit cannot be denied, but the fulness of their service may well be questioned and the direction of their force may often be condemned. While recognizing to the full the virtue of the show, it must also be admitted that it has been one of the greatest propagators of useless fads and fancies with which Agriculture has been burdened. So much so is this true that the commonplace man has come to regard the show animals with at least a measure of suspicion. Such has been the diagnosis of the hard headed frugal Scotchman of the old land, and may the writer, with some knowledge of shows in general, add that the Scottish show has not been a lone offender.

At any rate the Scotchman decided to put his Ayrshire Cattle house in order and in attempting to do so he had no easy task. Tradition and the established order of things are always formidable opponents. Moreover the old time show in Ayrshire, Scotland, as elsewhere, had made reputations which were not going to be readily sacrificed; it was performing a distinct service of a certain type for those who dominated it, and any interference with the channel of its influence meant serious disturbance. But the soundness of the cause and the justice of the case ultimately forced the issue with the result that the majority of Ayrshire breeders in Scotland who were keeping pure bred Ayrshire Cattle for their worth to the Dairy industry, organized a "New Show," a show designed to render a commercial service to Ayrshire cattle interests. Classes which would provide not only display, but also feature constructive breeding, were arranged, and a judging system was developed with a view to handicapping the drones, as well as putting a premium on production worth. A scoring system was designed which amounted to bonusing in three divisions the individual of merit. Individuality, mammary development, and accredited milk production received maximum bonuses of thirty, thirty-five and thirty-five points respectively.

The show was an overwhelming success. The new idea brought forth exhibits from all parts of the breeding country, the aged cow class alone including seventy-eight of Scotlands best cows, many of which were never shown and never would have been shown at a show on the old order. The judging system as outlined did not prove perfect under test but the idea was demonstrated to be workable and even in its present imperfect form did result in very largely attaining the object for which it was intended. It featured true worth in the Ayrshire cow and forcibly demonstrated where it lay. (H. Barton, Macdonald College.)

Hobsland Nancy 6th (57121); sire, Dalfibble Wide Awake (14386); dam, Hobsland Nancy (25738). Bred by and the property of Thos. Barr, Hobsland, Monkton, Scotland. Winner of the champion cup for the best Ayrshire cow or heifer, in milk or in calf, Ayr Show, February, 1921.

Anaesthesia in General Practice*

ALFRED SAVAGE, Macdonald College, Que.

According to its literal origin, the word "anaesthesia" means a condition of insensibility. A condition, however, is seldom absolute and must accordingly be expressed with regard to some other, or qualified by a word denoting its cause, origin, extent or purpose. Thus we speak of anaesthesia as local, spinal or general, as partial or complete, as that produced by cocaine or chloroform, or as being for a surgical or diagnostic purpose.

Pathological insensibility does not concern us under this title, so I shall confine my remarks to anaesthesia deliberately produced for some purpose, such as the control of pain.

Normal stimuli are transmitted through their various channels to the sensorium and there appreciated merely as sensation. Abnormal ones because of their nature or intensity are likewise transmitted but are appreciated as pain.

Now, contrary to popular belief, pain is not necessarily a bad thing. Like inflammation, while it is pathological, yet it is natural. It is a danger signal but not necessarily a danger in itself. It is a splendid protectant, an excellent safeguard against overuse of the part from which it emanates. But like some other natural phenomena it often overdoes its purpose, producing needless, if not harmful, reflexes where medical cases are concerned, and annoying, though perhaps futile struggles in surgical work. Its control is, therefore, often desirable—aside altogether from the fact that the patient does not enjoy it.

And I am tempted to add, in parenthesis, that in addition to preventing economic loss, restoring animal usefulness and protecting the public health, it is our duty, as veterinarians, to relieve our patients of needless suffering.

It is difficult to say just where the control of pain begins. In some lines of work, we use sedatives, anodynes and the narcotics. Thus when we apply belladonna and menthol liniment to a gargetty udder, or when we dose a colic case with Cannabis indica or morphine, we are relieving the patient from the appreciation of pain. The use of such drugs, however, is only the thin end of the wedge: anaesthesia is a more complete insensibility than is thus obtained.

Practical considerations compel me to speak of anaesthesia under the conventional headings of General, Spinal and Local.

General anaesthesia, as usually obtained, is really more than the name implies. In addition to insensibility to pain it includes loss of consciousness; the abolition of reflexes and complete muscular relaxation. Now, as it is seldom necessary to protect the whole animal against pain, these accompaniments are perhaps as important as the state itself. This point has already been emphasized by Muldoon (1), who gives the following indications for general anaesthesia:

1. *To secure muscular relaxation.*

(a) For the reduction of hernias and prolapses, dislocations and fractures;

(b) To abolish cramp—particularly of the vastus muscles, the so-called stifle cramp of horses;

(c) To facilitate obstetrical manipulations, the explorations of wounds, etc.

2. *To overcome nervous activity.*

In cases of strychnine poisoning, eclampsia, tatanus and convulsions.

3. *To produce insensibility for surgical operations.*

The means by which this state can be produced are many. A blow on the head is the cheapest method but is best confined to the packing houses. Of chemicals we have chloroform, ether, ethyl and methyl chloride, ethyl bromide, nitrous oxide and others that are best administered by inhalation. By way of mouth suitable doses of alcohol, chloral hydrate, morphine, hyocine and cannabis indica will suffice for certain species. Some of these substances can be given hypodermically and intravenously.

In choosing what agent to use, apart from the inhalation anaesthetics, alcohol and chloral hydrate, one has to make allowance for the species of animal under consideration. To illustrate—morphine is narcotic and anaesthetic for dogs in doses of from ¼ grain upwards, but it acts on fowl as an aphrodisiac and may convert a cat into a maniac—at least for the time being. Small doses are sedative to horses, large ones produce excitement. Cannabis indica is also somewhat variable in its action, not so much because it affects the various species differently, but because of the many individual idiosyncrasies existing towards it. In some horses it produces a narcosis so deep as to be practically anaesthesia, in others the same preparation will cause tremendous excitement. (2)

Now, because it is out of place to speak of all the substances that can be used for this purpose, and of their various actions on different kinds of animals, I am going to say a few words on chloroform and then pass on to other forms of anaesthesia.

Chloroform is easily the first choice as a general anaesthetic for large animals—particularly horses. The methods of its administration you know, so I shall not weary you with technical details. There are a few general rules, however, which experience has taught me are worth knowing and following:

1. *Have satisfactory control* of your patient before beginning to administer the stuff. In a nice grass paddock with a quiet horse and a suitable muzzle, the standing position is sufficient. In dealing with irritable or fractious subjects, it may be the only method that can be used at all. Personally, when possible, I prefer to cast the animal with Baker hobbles and then I am sure that he cannot bounce around very much. In this connection, let me quote from Dr. D. S. White (3): "Perfect, or even good, surgery is impossible without perfect restraint. The surgeon is no better than the restraint method which he uses . . . Imperfect restraint means an imperfect operation." This general truth also applies to the man who gives chloroform.

2. *Use only the best chloroform* obtainable regardless of cost. If it is worth while using it at all, use the right stuff and do your best. No matter what care is taken in other respects, poor chloroform may finish the patient on the spot or produce bronchitis or bronchopneumonia that can easily nullify the effects of the operation perhaps a week or 10 days later.

In this regard too, it is well to remember that even

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*Read before the Ontario Veterinary Association, Feb. 18th, 1921.

the finest chloroform is not a very suitable compound and should be kept in a dark coloured bottle, or better, away from the light.

3. *Use a synergist* if the anaesthesia is to be prolonged.

Properly given, good chloroform can be administered for a considerable time without danger. But less is needed and the effect is greatly enhanced if the animal has been prepared by a suitable dose of morphine – say 3 or 4 grs. hypodermically, or chloral hydrate given either *per os* or intravenously. We consider it "good medicine" to use synergists when prescribing to secure purgation or some other effect. It is equally good when anaesthesia is the end desired.

I should like to digress for a moment on these last two points. Three years ago Dr. Glover and I spent a good many days trying to rectify some bad chloroform. The only stuff issued at that particular time was fatal in nearly 50 per cent of the cases to which it was given. Fractional redistillation with passage of the vapor over lime and some other substances reduced its deadliness to about 20 per cent. Finally, in order to avoid poisoning even that proportion of our horses that had escaped German shell fire with nothing worse than an accumulation of assorted hardware morsels in their works, we began using chloral hydrate as a narcotic giving just enough chloroform in addition to produce the necessary anaesthesia. This gave good results.

As my attitude on the use of chloral hydrate (4) seems to have been widely misunderstood, may I say plainly that I do not propose to use it to the abolition of chloroform. I decidedly prefer it to bad chloroform and, under some conditions, consider it a useful adjunct even to the best.

4. *Allow plenty of opportunity for unhampered breathing.*

A beast that is trussed like a fowl with hobbles, a surcingle and some one sitting on his chest has a poor chance of behaving as he should.

5. *Watch his breathing*, and at the first sign of irregularity or stopping, remove the chloroform and, if necessary, resort to artificial respiration.

6. *Allow plenty of time*, in other words chloroform the horse, don't choke him. There are two extremes to be avoided, the first is giving the animal such a dose of concentrated vapor that he dies from cardiac syncope, the second is consuming the necessary time to be quite safe. Hobday (5) states that 1 per cent mixture of chloroform vapor is perfectly safe, but requires to be given for an hour in order to produce anaesthesia. The compromise of reason allows the animal about 10 or 15 minutes to reach the required stage.

7. *Have antidotes handy in case of emergency.*

They may not be needed, but they are like fire extinguishers. When you want them you want them badly. The substances that answer the purpose are all respiratory and heat stimulants. Camphor (10 p. c. in oil), strychnine, and atropine for hypodermic use, *Aq. ammon. fort* for inhalation and dilute hydrocyanic acid (Scheeles) that may be given orally. The use of the last named is specially stressed by Hobday.

And, there is one DON'T that I should utter. Don't try to chloroform an unsuitable patient. Animals weakened from a severe respiratory disease, affected with heaves, or in fat soft condition are poor subjects. Contrary to expectations perhaps, I have found fairly debilitated horses rather good in this respect.

I think if these rules were followed more closely, the use of chloroform would be generally indulged in and with greater confidence. This might not be so, however, in general practice, because the practitioner works largely alone—he cannot divide his attention between the operation and the anaesthetic, he has no trained assistant on whom he can depend, and he knows more than to trust a novice or the owner. Moreover, the extended use of local anaesthetics and narcotics, or a combination of both, offers a way out of using chloroform in a great many instances. So much on that score.

I mentioned spinal anaesthesia: it seems unnecessary to do more. It has been used for small animals, and, experimentally, for large ones too. There is no present reason to believe that this method will be of much use to the general practitioner.

Local anaesthesia, on the other hand, is a topic of great and ever growing importance. This condition and its development into regional anaesthesia is something with which most practitioners can not afford to be unfamiliar.

One may briefly summarize its advantages as follows:

1. It is safe;
2. Easily obtained without skilled assistance;
3. Because it does not affect the respiratory and digestive tracts, it may be used without dietary preparation of the patient, without particular regard to his position and without fear of general after effects.
4. By its use the element of surgical shock is eliminated.
5. It has certain special applications—particularly in the diagnosis of obscure lameness, to which general anaesthesia cannot be applied.
6. Skilfully used, in conjunction with a narcotic, it enables one to perform humanely most of the operations that would otherwise call for a general anaesthetic.

Local anaesthesia may be brought about in a number of ways. Sufficient compression for a time will induce it, though this means in practice is incidental usually to the application of a twitch.

Cold has been made use of both by the application of freezing mixtures or ice, and by the evaporation of a volatile spray of ether or ethyl chloride. This refrigeration, however, is superficial and not of much practical veterinary value.

Finally, there are chemical agents. Certain of these —phenol and some essential oils, are confined to external use. Others constitute the infiltration anaesthetics as typified by cocaine. Before speaking of these substances in any detail, I should like to review the properties of the ideal local anaesthetic of this class, in spite of its non-existence.

It is:

1. Freely soluble in water.
2. Chemically stable and devoid of certain incompatibilities.
3. Resistant to heat up to 250 deg. F.
4. Non-irritant locally.
5. Non-toxic when absorbed into the system generally.
6. Efficient and moderately durable in its effect.

The first local anaesthetic of consequence to be used was cocaine. In certain respects it is still the best, though it has some important defects when compared with the theoretical ideal. It does not stand boiling, and its toxicity is well known.

Attempts to overcome these defects led to the intro-

duction of many other substances—a host of them in fact—notably Novocaine, eucaine, stovain, quinine and urea hydrochloride and, fairly recently, apothesine. Most of these newcomers are an improvement over cocaine because of their lower toxicity and their resistence to heat. They are inferior as a whole in their anaesthetic effect.

Writing in the "Journal of Laboratory and Clinical Medicine," November, 1918, H. C. Hamilton describes a series of experiments to test the relative value of Cocaine, Novocaine and Apothesine. Intracutaneous administration of these three proved that:

1. Novocaine is about half as efficient as cocaine;
2. Apothesine is practically equal to cocaine in anaesthetic value.

Cocaine, however, is superior to the other two applied to mucous surfaces.

Concerning the manner of using these substances, little need be said. Solutions of them in various strengths, usually of from 1 to 5 per cent, are injected hypodermically, intramuscularly or perineurally, according to requirements. When a mucous surface such as the conjunction is to be anaesthetized, a 10 per cent solution of cocaine can be painted on to it.

In all cases there is a delay of from 5 to 10 minutes (usually) before the effect reaches completeness. This varies with the particular substance used and its concentration.

The duration of the anaesthesia depends not only on the agent employed but on the part involved and the time required for its absorbtion. It is pretty well known, I think, that quinine and urea gives a very lasting effect, though it is peculiar in not affecting the skin nearly so much as the underlying tissues.

A word about absorbtion or rather, about non-absorbtion. It is evident that if the localization of these infiltration anaesthetics can be prolonged, their toxic effect is lessened and more of them can be used. I am again approaching the subject of synergists, because we have a preparation of very great value in this respect. I refer to adrenaline.

I have satisfied myself that a 1 per cent solution of cocaine used hypodermically with 1 : 50,000 adrenaline gives just as rapid, extensive and complete an anaesthesia as 3 per cent cocaine alone.

Dupuis and van den Eekhout (6) state that using a 2·5 per cent—3 per cent solution of cocaine with about the same proportion of adrenaline, they obtained anaesthesia in nearly 300 cases that lasted quite constantly for about 3 hours!

Eye work, however, affords an exception. Anything less than a 5 per cent solution of cocaine dropped into the conjectival sack is almost useless, and adrenaline does not appear to help the effect very appreciably.

And, finally, a word about the application of local anaesthetics to obtain regional anaesthesia. This is obtained by "nerve blocking." For example, if both plantars are cocained just below the knee, the limb distal to the site of injection is practically anaesthetized. If the medium and ulnar nerves are so treated, nearly the whole arm is without feeling. The procedure has a distinct advantage over the extensive infiltration of a large operative site, but is limited in its application for purely anatomical reasons.

Modern human surgery began nearly a century ago with the introduction of antiseptics and anaesthetics. They are its legs, so to speak, and on them it has made strides that would startle even the most visionary healers of two generations past.

Veterinary science follows. It is some distance in the rear perhaps, but rapidly coming into its own. In closing, gentlemen, I assert that you and I can materially hasten its arrival by the more extensive and better use of anaesthesia in general practice.

References.

Some of the following have been freely quoted:—

(1) Muldoon, W. E. "Anaesthesia and Narcosis." Report of the New York State Veterinary College, 1916-1917. Ithaca, N. Y.

(2) Muir, E. S. "Action of Certain Somnifacients on the Horse." Journal Comparative Medicine and Veterinary Archives. Philadelphia, Vol. 21, No. 4, April, 1900 et seq.

(3) White, D. S. Foreword to "Animal Castration." Nashville, Tenn.

(4) Savage, A. "Surgical Narcosis of Horses by Chloral Hydrate Given Intravenously," Vet. Journal, London, Nov., 1919.

(5) Hobday, F. "Veterinary Anaesthetics," London, 1915.

(6) Dupuis & Van den Eekhout. "Cocaine and Adrenaline as local Anaesthetics." Reviewed in Journal Comp. Pathology, London, Vol. 22, p. 35, 1919.

The formula is as follows:

Cocaine hydrochloride—2·5-3·0 Centigrams.
Adrenaline hydrochloride (1-1,000)— 5 drops.
Water, 10 grams.

FELLOWSHIPS AND HONORARY MEMBERSHIPS.

The constitution of the Canadian Society of Technical Agriculturists makes provision for Honorary Members and for Fellows. The former are not eligible for regular membership but are elected upon the recommendation of the Dominion Executive Committee for "rendering the profession valuable or special service." Fellowships are granted for professional distinction only and those to whom this title is given are chosen from the regular members. The by-laws provide, however, that there shall not, at any one time, be more than thirty Fellows, and that until that number has been reached not more than five may be appointed at any one annual Convention.

At the present time the C. S. T. A. has no honorary members and no Fellows. Provision has been made, however, in the programme of the first Annual Convention, to be held at Winnipeg on June 15, 16 and 17 next, for consideration to be given to the appointment of distinguished members and non-members, to these two classes.

This new Society—the Canadian Society of Technical Agriculturists—is now well established and has earned a reputation for quick and thorough organization. It is to be expected that any policies adopted or lines of work undertaken will be carried out with the same thoroughness and expedition that have characterised its progress during the first year of its existence.

Entomogenous Fungi

By ALAN G. DUSTAN.
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In carrying on investigational work, especially where an outbreak is severe, the entomologist often finds that many of the insects under observation are killed by an unknown disease. The insects so affected often assume weird and unnatural shapes, become hard and mummified and in many cases are covered with a white growth. Closer observation shows that this condition has been brought about by a fungus which has gained access to the body of the insect where it has developed at the expense of the softer tissues.

These fungous diseases, known technically as entomogenous fungi, have been recognized for a great number of years but it is not until comparatively recently that they have been considered of importance from an economic standpoint. Previously they were looked upon merely as interesting biological phenomena, but today it is known that they may be often used with great effectiveness in combatting many insect pests. The work of these fungi in a great number of cases has been grossly exaggerated but in numerous instances such diseases have played a very important part in controlling some of our severest outbreaks.

Unfortunately, however, these fungi will not grow in all countries nor at all seasons of the year, and as a result many attempts to use and artificially spread entomogenous fungi have been unsuccessful. Like other types of fungi they prefer a warm, moist climate, with plenty of rainfall and a high relative humidity. In hot, dry weather they cease to grow and in many cases form resting spores to carry them over such unfavourable seasons.

In regard to the hosts or insects which they attack, entomogenous fungi do not always show much discrimination. Some diseases have been recorded as attacking only one species of insect host. In other cases the same fungus may be found on a number of genera in a certain family. And in certain instances one species of fungus will attack insects in seven or eight orders. As an example of this last type I might instance the common insect fungus, *Entomophthora sphaerosperma*, which has been found growing on representatives of the following orders: Lepidoptera, Hymenoptera, Diptera, Coleoptera, Hemiptera, Neuroptera and Thysanoptera.

The liability to infection by these fungous diseases is shared alike by larvae and pupae and in certain cases even the adults are known to be attacked. It is in the immature stages, however, that insects are most susceptible, although in certain orders, notably Lepidoptera, the occurrence of disease among the adults is not uncommon.

Looked at from a purely biological standpoint, the work of entomogenous fungi is a most interesting phenomenon; but viewed in the light of an important control factor, the mycoentomogist sees in these fungi a possible ally which may be used to help him fight insect outbreaks with the minimum amount of labour and cost. For the last forty years experiments have been carried on all over the civilized world to test out the work of these fungi and to see if they can be spread artificially or not. In most cases the results have been disappointing but in some cases the efforts of the investigators have been crowned with great success. From the viewpoint of the practical mycoentomologist, however, no matter how interesting a fungus may be, it is of little use if it is not amenable to cultural methods and artificial dissemination among the insects he wishes to control.

Early Work With Fungi.

The first description of an entomogenous fungus was written in 1754 by Father Torrubia. The insect in question was a wasp collected in Havana and attacked by what is now thought to be a species of *Cordyceps.* Of course, previous to this time fungous diseases growing on insects had undoubtedly been noted, but this is the first authentic case where a disease was actually studied and described. From that time onward this subject gradually began to attract the attention of scientists and scattered through the older literature we find accounts and popular descriptions of these fungi.

It was not till 1880, however, over a hundred years after the time of Father Torrubia, that entomologists conceived the idea of making use of these fungi to help them in fighting insect outbreaks. From Russia comes the first record of work done in connection with the artificial use of entomogenous fungi. In 1880, Metschenikoff found that the cockchafer of wheat and a sugar beet curculio were both susceptible to a disease commonly known as the "Green Muscardine." His infection experiments with the cockchafer were only in part successful but the same experiments with the curculio were very successful. A little later (1888) another Russian entomologist carried on a similar set of experiments with the same disease and was successful in bringing about an eighty per cent mortality among the curculios.

The success of the Russian scientists was infectious and within a very few years experiments with entomogenous fungi were being carried on in many countries. As a result we find that today this subject is attracting the attention of entomologists in various parts of the United States, in Hawaii, South Africa, South America, and to a lesser extent, in most of the other civilized countries.

Systematic Position of Entomogenous Fungi.

Entomogenous plants in general may be divided into three main groups. First, the bacterial forms which produce diseases in insects; second, the entophytous algae; and thirdly, the fungi which are parasitic on insects. Of these three only the last-mentioned will be considered under this heading.

Entomogenous fungi can be roughly grouped into three classes, according to the type of spores they produce. The first group includes those forms which are characterized by the production of zygospores and azygospores and is represented by the family *Entomophthoraceae.* In the second group we find those fungi that have their sexual spores born in an ascus, known as ascispores and included in the order *Ascomycetales.* In the last group are found those fungi which of necessity are classified with the Fungi Imperfecti, on account of the fact that only part of their

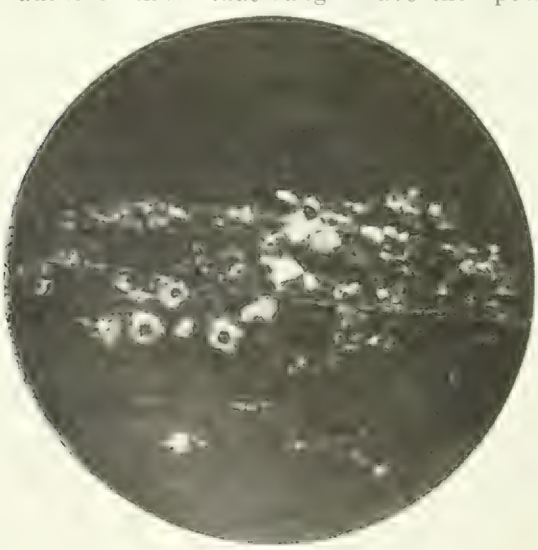
Green Apple Bugs
Attacked by a Fungous disease
(Photo by L. G. Saunders).

life-history is known. The most of the last class are supposed to belong to the second group ,the ascus-bearing fungi, but are placed temporarily in the Fungi Imperfecti until more is known of their ascigerous stage, without which knowledge they cannot be classified.

Life History of a Typical Entomophthora.

Infection among entomogenous fungi results, in most cases, from contact with a conidial spore which, adhering to the insect host, enters its body by means of a germinating hypha or tube. Although this process has never yet been actually seen, it is generally supposed that the hypha penetrates the insect's body at some point where the integument is less highly developed, as, for instance, between the body segments or joints of the legs or perhaps directly through the stigmata. It has also been proven that in some cases infection results when the spores are taken directly into the stomach with the food, but this method is not so common as the one first mentioned.

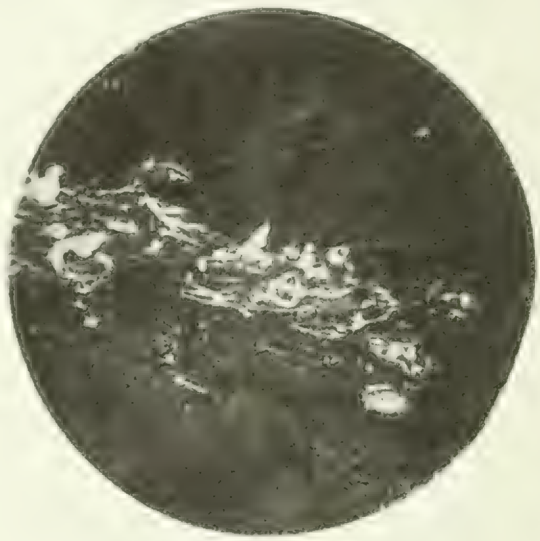
After the hypha of germination has entered the host it grows and develops at the expense, first of the softer tissues but later of those parts more highly chitinized. Many authors think that fungi have the power of secreting some liquid which acts on the body tissues of the host and helps to break them down and convert them into food for the developing plant. This is probably a fact, for it could only be through the agency of such a digesting secretion that the fungus would be able to break down the harder tissues as it does.



Opionectria coccicola.
The white-headed fungus of purple scale.

In growing, the fungus does not usually form a threadlike, branched mycelium, but multiplies by means of what is known as hyphal bodies. Those hyphal bodies are short, thick fragments of the plant of varying size and shape, which grow by means of budding, and in many cases look like yeast cells. They are found first in the blood stream of the host, but as they increase they penetrate every part of the body and when the tissues are all consumed and the insect finally dies, the exo-skeleton is found to be entirely filled with them. Should conditions at this stage become unfavourable for further growth, these hyphal bodies become rounded up, surround themselves with a heavy cell wall and become resting or chlamydospores, in which condition they are able to remain for long periods of time.

Under more favourable conditions, however, the fungus proceeds to complete its growth and each one of



Sphaerostilbe coccophila.
The red-headed fungus of San Jose scale

these resting spores germinates and sends out a delicate hyphal tube. The germination of this chlamydospore results in the formation of either sexual or asexual resting spores, or of conidiophores bearing conidia. If conidia are to be formed, the germinating tubes grow rapidly upward and burst through the thinner and softer parts of the insect's body. Sometimes they are branched, but in the simplest forms they grow upright as simple, unbranched conidiophores. At the extreme tip of these upright hyphae the conidia or spores are borne and when mature they are shot off into the air with amazing force, where they float around until they come in contact with a suitable insect host. This they adhere to by means of a sticky substance with which they are surrounded, and at once send out a germinating tube which enters the body of the insect, as already described. Should the conidia alight on a substance unsuited to its development, secondary conidia are formed and in turn shot off into the air in the hope of reaching a more favourable food supply. These secondary conidia are formed from the primary ones in a very

simple way. The primary one germinates and sends out a hypha or tube of variable length, which, growing vertically upwards becomes swollen at its extremity and produces a conidium similar to the one from which it was derived. In some cases a tertiary conidium is formed from the secondary one, should unsuitable conditions still be met with, the conidium in each case being smaller than its predecessor.

It is now necessary to return once more to the condition in which we find the host filled with chlamydospores or hyphal bodies, in order to consider the formation of the asexual or sexual resting spores—known technically as azygospores and zygospores—which are formed when very adverse conditions are met with. The passage to the resting condition may be accomplished by a wholly non-sexual process in which case we get an azygospore; or else a sexual spore, or zygospore, may be formed by the fusion of the contents of two hyphae. In either case the product is a spore having very thick walls and capable of withstanding great extremes of temperature and humidity. Most fungi are carried over the winter by means of these spores. In the spring when conditions are favorable, they germinate in the same manner as the conidia did and send out germ tubes bearing upright conidiophores, at the tip of which are borne the conidia.

Thus we see that there are really four kinds of spores. First, conidia, which are typically summer spores and by means of which the fungus is spread; secondly, chlamydospores or thin-walled resting spores, useful in tiding the fungus over short periods; and thirdly, thick-walled spores, known as zygospores, if they have been formed by a sexual process, or azygospores, if no fusion has taken place previous to their formation. These last two types of spores are formed when a long period of adverse conditions is encountered.

This, in brief, is the life history of a typical member of the Entomophthoraceae, the most important family of entomogenous fungi we have.

Methods of Spreading Entomogenous Fungi Artificially.

Before a fungous disease can be of any great use in combatting insect outbreaks it must lend itself readily to artificial spread and must have the power, under suitable weather conditions, of inoculating those insects with which it comes in contact. There are many diseases known, which, although they may be present in small amounts each year, yet never reach a state of epidemic and cannot be spread artificially. Such fungi can never be of much use to the mycoentomologist. Years of experimenting have shown quite clearly that of all the entomogenous fungi known, only a very small percentage are of use from an economic standpoint.

The methods of spreading fungous diseases of this type are very varied—varying greatly with the insect attacked, the species of fungus and the country in which they are found. A method which might be productive of good results when used in Florida might be a total failure in Canada and because a certain method has been tried successfully on one species of fungus does not prove that it will be equally successful on another. Each special disease has to be studied intensively in its native habitat and carefully experimented with before it is safe to say whether it is amenable to artificial dissemination or not.

Briefly, the four most generally used methods of spreading entomogenous fungi are as follows:

(1) Where the conidia are suspended in water and sprayed on the insect-infested trees.

(2) Where insects which have been artificially inoculated with the disease are liberated in the field among healthy ones.

(3) Where portions of trees (leaves, twigs, pieces of bark, etc.) bearing the fungus, are fastened to trees infested with the insects to be inoculated.

(4) Where the spores are mixed with the food and infection takes place through the alimentary canal.

Wool Grading as it Affects Canadian Wool Sales

A. A. MacMILLAN, Live Stock Branch, Ottawa.

The responsibility of establishing suitable grades for Canadian wools has continued to remain a feature of the activities of the Sheep Division of the Live Stock Branch. During the period of the war, when prices were continually rising and when prices for lower grades of wool approximated very closely those of finer grades, there was not the same necessity for close grading, but in 1919, when prices began to drop, it was apparent that the standard for Canadian grades of wool must be made stricter; otherwise grade rejections on the part of purchasers would result in cancellation of same. Before commencing grading in 1920 it was decided to bring the grades up to a very high level. This was accomplished, the result being that throughout the entire season there were no cancellations of sales owing to questionable grading, and the establishment of grades that met trade demands played an important part in 1920 sales.

Canadian wools are now classified into eleven main grades which include combing and clothing lengths. Owing to the effect of climate, soil and system of management the grades are again separated for sale purposes into two main divisions. Wools east of Fort William are known as Eastern Domestic, whereas, those west of Fort William are known as Western Domestic and Range Wools. Owing to alkali and soil drifting in Manitoba and parts of Saskatchewan and to the affect of burnt off land in British Columbia, a further subdivision was made in these provinces, on the basis of brightness, the grades being subdivided into Bright, Semi-Bright and Dark. Grading as carried out in 1920 allowed each province to reap the full benefits of the selling qualities of their respective wools. This was made possible largely as a result of the consolidation of the grading work at Weston, Guelph and Lennoxville. Field grading, although educative to farmers locally, made it difficult to maintain uniformity of grades, which is now essential if Canadian wools are to stand up in competition both on the Canadian, United States and British markets. Farmers now have a more or less general knowledge of the various grades and there was no good reason why consolidated grading should not be effected. Besides making for greater uniformity it permits of blending certain wools from a number of provinces into one grade when otherwise there would not be enough from any one province to make it worth while. The subdivision within the grades permits farmers with

the finest and brightest wools to reap the benefits of better methods of management and breeding.

Consolidated grading also reduces costs very materially as there is little or no loss of time on moving costs.

In addition to the regular grades provision is also made for at least fifteen main classes of reject wools. This minute classification again facilitates sales to the greatest possible degree.

In the matter of wool qualities Canada stands on a very high plane. The bulk of the combining wools are suitable for the manufacture of high-class fabrics, but unfortunately we have not developed an extensive worsted industry for using the home grown produce. The result is that for the most part Canadian Combing Wools have had to find a market outside the Dominion. The clothing wools are also mainly of the finer grades and have usually found a ready market at home. Grading and improvement in preparation for market has had a very marked effect in bringing our wools into more general use by Canadian mills. A number of mills have used Canadian wools for the first time this year and express general satisfaction as to grades and qualities. It is hoped, therefore, that the home consumption of Canadian wools will increase from year to year.

A closer study is being made of grades to obtain a more thorough knowledge of their respective marketing values. This year a sorting test was made of each grade by provinces and in addition to acting as a check on the

Early method of delivering wool at local grading centres.

grading work it has served to point out where many grades are lacking in certain particulars and is suggestive of certain phases of improvement work which might be undertaken. Owing to the general demand for a finer class of goods and also to the fact that this demand is likely to continue as a result of a higher plane of living, the importance of raising the general average of wools to a higher grade level is fully appreciated and it is hoped, by making a further study of the wools from breed improvement work, as carried on by the Experimental Farms and Agricultural Colleges, to ascertain more or less definitely the laws of heredity as they operate to effect wool qualities.

In the matter of wool improvement the value of the pure bred sire is not lost sight of. The operation of the Premium policy and the organization of ram clubs are bringing about a much more general use of breeding sires and payment on the grade basis, which follows as a result of grading and co-operative selling, has done much to induce farmers to pay closer attention to the culling and selection of the ewe flock with a view to breeding a heavier and finer fleece.

A scouring test has also been completed which shows by comparison the scoured yield of the various grades. The scoured yield is the basis on which all mills purchase and the results will serve as a guide to the farmers organizations in selling and will also prove beneficial to intending purchasers.

At the present time Canada produces approximately 22,430,599 pounds of wool. This figure is based on the estimated sheep population for 1920 which is placed at 3,720,783 head. As these estimates are taken in June it is safe to assume that 35% of the sheep population at that time is lambs and assuming the average weight of a lamb's fleece to be 4 pounds at killing age there would be an annual production of some 5,209,092 pounds of pulled wool at least 50% of which will be of clothing lengths. There is probably another 5,000,000 pounds or more worked up at home for homespun, etc., leaving approximately 10 to 12 million pounds which goes through the regular trade channels. In Eastern Canada fully 95% of the wools are of combing grades and are suitable for the manufacture of worsted fabrics, felts, sweaters, linings, braids, upholstering and carpets. In Western Canada about 60% of the wools are of combing lengths and the balance, clothing grades. The clothing grades are suited for the manufacture of tweeds, underwear, hoisery, sweaters and blankets. Between four and five million pounds of Canadian wool will be of clothing lengths.

Canada should be one of the heaviest wool consuming countries in the world owing to the rigour of her climate and the fact that no textile is warmer and wears better than wool. It is a regrettable fact that during the past year something over 37,000,000 pounds of rags and wool wastes were imported into Canada and that our total purchasings in wool and woolen goods is valued at $63,493,535.00, whereas our total sales of wool and woolen goods amounts to only $16,959,725.00.

Allowing for a per capita consumption of 8 lbs. grease wool or 6 lbs. scoured wool and figuring our present population at 9,000,000 it would require 54,000,000 lbs. of manufactured goods, or, allowing for an average addition of 50% wool substitutes as filler the required raw product would be 37,800,000 pounds scoured wool or practically double our present production.

Canadian people at present are not generally aware of the qualities of Canadian made goods and many excellent goods of Canadian manufacture are sold as imported because the public apparently have been educated to favor the imported article.

If we were to allow two acres per sheep for occupied, but unimproved land in Ontario, Quebec and Prince Edward Island, four acres in New Brunswick and Nova Scotia and five acres in Western Canada, this unimproved land has a carrying capacity of 17,557,790 sheep and in addition in all the provinces there are vast tracts of unoccupied land much of which is suitable for sheep.

Canada undoubtedly offers room for the expansion of the sheep industry to almost any limit. The unimproved land for the most part is cheap and no animal will make it more productive and profitable than sheep. Our people require much more wool than we produce. We have perfected a selling agency whereby Canadian wools may be sold on a par with any wools in the world. Let us organize the business of wool production so that we may not only have our own selling agency, but also that we produce sufficient wool for our own needs with a surplus for export, that we manufacture our woolen goods and wear Canadian grown wools.

Spraying vs Dusting

C. E. Petch, Dominion Entomological Laboratory, Hemmingford, Que.

(Paper given at the 13th Annual Meeting of the Quebec Society for the Protection of Plants.)

Epraying and dusting orchards have been carried on generally for several years. In the case of spraying it is about forty years and of dusting about ten years. Therefore, the dusting system is working under the handicap of 30 years investigation and application. If the two systems had developed together it is impossible to state which would be the more efficient and popular. However, we must judge between the two from the evidence at hand.

In the preparation of this paper the writer was fortunate in having before him an article by G. E. Sanders and A. Kelsall in the January issue of "Scientific Agriculture." These writers covered the subject quite thoroughly and their article will be followed fairly closely, but enlarged or criticised to suit Quebec conditions.

Dusting has many advantages over spraying, and if it were not for the severity of black rot canker in Quebec spraying might have no advantages over dusting. In this age of high operating expenses speed is one of the main economic points to consider. Dust can certainly be applied much quicker than liquid and the writer's results have shown dusting to be three or more times as fast under similar conditions. This speed allows an application to be made at the proper time, that is during the beginning of a humid spell or at the regular spraying periods mentioned in the spray calendars.

The first year that the writer dusted, the results were excellent for the control of apple scab, in fact, better than with liquids and the applications were made during the heat of the day. However, since then results have not been so good and it is probably due to dusting in the afternoon instead of in the morning or evening. The results of the first year would indicate that dusting could be done any time during the day and good res lt; be obtained. The advantage of the early morning and evening over the intervening period seems to have been well established by other workers. The above observations show dusting to be a time-saving method since dust is best applied during the part of the day unfavorable to most farm work; spraying on the contrary requires the best of weather and the most important part of the day. The initial expense in purchasing a dusting outfit is about one-half that of a sprayer and the upkeep is considerably less. Sprayer parts soon become corroded and worn out but the chemicals in a dry state have little effect upon the duster. Therefore, the cost of upkeep is much less and the saving in time is also considerable because with a sprayer the broken parts are always discovered when it is in use. The most important and busiest part of the spring is no time for delays and they are not infrequent where sprayers are used. Furthermore, to replace broken sprayer parts is a difficult and tedious job, owing to the awkward position in which many of the parts are located. With dusters most of the parts are easily accessible. It is also true that the duster ready for action weighs less than a sprayer but this is not important in the majority of Quebec orchards.

The two outstanding advantages in favor of dusting are: (1) When fungous diseases develop most rapidly the weather is most suitable for dusting but not for spraying; and, (2) the greater speed, which allows rapid treatment of large areas.

Aside from the above differences, it must be remembered that both systems must primarily be satisfactory for the control of fungous diseases, biting and sucking insects. Of the fungous diseases black rot canker and apple scab are our two most important apple diseases. As to the former, there is no evidence, to the writer's knowledge, to prove that dusting is or is not satisfactory for its control but for the latter there is plenty of data to compare the two systems fairly satisfactorily.

The following figures are taken from Sanders' & Kelsall's article in Scientific Agriculture, Vol. 1, No. 1, pp. 14-18.

	Years.	Unsprayed.	Sprayed.	Dusted.
New York	4	43·2	11·4	12·2
Michigan	4	71·4	20·9	20·8
Illinois	4	70·4	19·1	19·9
Nova Scotia	4	51·4	12·4	12·4
Average of	16	56·5	15·6	15·6

The above table contains the average for four years and includes years of light and heavy scab infestation. However, since heavy infestations are the most valuable tests the following data are quoted:

Region.	Year.	Unsprayed.	Sprayed.	Dusted.
New York	1913	50·6	28·5	31·4
" "	1914	86·0	15·5	14·2
Michigan	1915	100·0	49·1	58·2
"	1917	99·9	14·1	10·5
"	1919	62·4	15·2	12·6
Illinois	1915	67·5	9·0	7·0
"	1916	68·4	0·9	14·7
"	1917	81·8	28·4	27·1
"	1918	67·6	37·8	30·9
Nova Scotia	1919	90·8	21·1	11·4
" "	1920	51·4	29·7	40·0
Average of 11 years		75·1	22·7	23·5

The above tables show neither system to have the advantage when all the years were considered but when only the heavy infestations are considered there is a slight difference amounting to ·8 per cent in favor of spraying. At Hemmingford the following results were obtained in years of heavy infestation:

Year.	Unsprayed.	Sprayed.	Dusted.
1917	80·0	1·0	3·8
1918	95·0	·4	·4
1919	93·0	20·5	62·3

The above figures show both systems were satisfactory in 1917 and 1918 but decidedly otherwise for dusting in 1919. There were 3 days separating the 3rd application in 1919. The spraying was done on the 17th and the dusting on the afternoon of the 20th. The weather was as follows:

17th—Misty and warm.
18th—Clear and very warm.
19th—Very warm rain at night.
20th—Cloudy, warm and muggy.

It is very probable that the scab developed very rapidly during these few days and was largely responsible for the heavy infestation of the dusted apples.

The sprays used were chiefly lime sulphur and arsenate of lead and dusts arsenate of lead and dust sulphur. However, in Nova Scotia Bordeaux mixture was used sometimes and in Quebec arsenate of lime was used on several occasions both in sprays and dusts.

Another very important thing to consider is the injury to foliage and fruit due to burning. This has appeared more or less severely for the past four years in the sprayed areas but as yet there has been no burning from the application of dusts, which have contained as high as 15 per cent arsenate of lead or 10 per cent arsenate of calcium.

So far as biting insects are concerned all the results the writer has seen show dusted arsenicals as good, and, in most cases, better than sprayed arsenicals. In this connection the following figures on wormy apples are taken from Sanders' & Kelsalls' tables:

Place.	Years.	Unsprayed.	Sprayed.	Dusted.
New York	4	22·0	7·8	5·0
Michigan	2	12.0	0.4	0.07
Illinois	4	44·7	8·8	8·5
Nova Scotia	4	6·6	3·7	2·9

The above figures are all in favor of dusting. The codling worm upon which apparently the above figures are based is only of minor importance in Quebec but the following figures are for insects of great economic importance here:

Variety.	Year.	Unsprayed.	Sprayed.	Dusted.
Alexander	1917	99·0	10·7	11·0
Duchess	1918	100·00	3·0	2·0

Further it is very interesting to note that this year (1920) dusting for the control of the apple maggot gave better results than any spraying results ever obtained here. A mixture containing 45 per cent sulphur, 47½ per cent hydrated lime and 7½ per cent calcium arsenate, was applied on July 19 and on August 5th. The dusted trees had less than 1 per cent of the fruit attacked but the check trees had from 50 per cent to 90 per cent of the fruit injured.

Another very important consideration in comparing these methods is their relative value in controlling sucking insects. In many fruit growing sections this would probably be the most important phase of the subject but in Quebec it is by far the least important and hardly needs consideration. It is only rarely that aphids are present in sufficient numbers to be of economic importance and the oyster shell bark louse could probably be held in check by dusting.

One of the most difficult comparisons to make is that of cost, because present day dusts are only experimental formulae and as this part of the work is in such a rudimentary condition it is difficult to arrive at conclusions that are satisfactory. However, the following figures are based on experimental work done at Hemmingsford:

1917, spraying, \$16·09; dusting, \$30·50
1918, spraying, \$23·70; dusting, \$40·40.
1919, spraying, \$27·58; dusting, \$27·26.

The above figures for 1917 and 1918 show dusting almost twice as costly as spraying, whereas in 1919 the cost is practically the same. The cause of the great reduction in the cost of dusting was in using a mixture in which the sulphur and poison were greatly reduced and replaced by a cheap filler. If it were not for severe russetting, in some seasons, of our best varieties, Fameuse and McIntosh, Sanders' copper lime arsenic dust would be the cheapest to use, but owing to this defect it is not advisable to use it for the calyx and later applications.

The question of mixtures to suit the numerous conditions existing in various parts of the country is a broad one. So far very little information is at hand but if the work of the past few years is continued with as much interest for the next ten years, there will probably be dusts equal to liquids for any condition which might arise.

Conclusions.

1. Dusting has developed very rapidly in the past 8 years.
2. The results of experimental work in New York, Michigan, Illinois, Nova Scotia and Quebec show dusting to be as efficient as spraying in the control of apple scab and biting insects.
3. The cost of dusting in the past 2 years has been practically the same as spraying under Quebec conditions.
4. The two most important insecticides, calcium arsenate and lead arsenate may be safely used with either system.
5. Without any reliable data to hand it must be stated that dusting is inferior to spraying for the control of sucking insects. However, there is sufficient evidence at hand to cause us to believe the solution of this problem will be discovered in the next few years.

CROP PEST COMMITTEE FORMED.

Regina, Sask., April 14.—Meeting of entomologists of the Federal and Provincial Governments, and some of the Western States, held during the past two days, to discuss the grasshopper menace, resulted in the formation of a permanent committee to be known as the North-West International Committee on Crop Pests. Norman C. Riddle, Federal entomologist, was appointed chairman. It was decided to hold the next meeting in one of the Western States.

In discussing ways of controlling crop pests, it was stated that grasshoppers could be destroyed by deep ploughing before they hatch, scattering straw among the insects on the roadsides, and burning it at night, and employing poisoned bait.

THE WINNIPEG CONVENTION.

Members of the Canadian Society of Technical Agriculturists (and prospective members) who are going to attend the First Annual Convention at Winnipeg on June 15, 16 and 17, should advise the General Secretary as soon as possible, and not later than May 31st. Accomodation will be reserved if desired, but notice should be given in any case to facilitate preliminary arrangements and in order that an estimate may be formed of the probable attendance.—Address all communications to Fred. H. Grindley, Gardenvale, P. Q.

Marketing Farm Produce

Dean F. M. CLEMENT, University of B. C., Vancouver.

The problem of the marketing of farm produce differs from the problems of production in that it is entirely in the abstract. It is something that you cannot see or feel; but at the same time must be understood and visualized. Without a more efficient marketing system it is doubtful if from the point of view of the farming community increased production is going to increase the total value of farm products to any great degree.

It cannot be said that any large body of people are all consumers, and another large body of people all producers. We may be producers of strawberries, wheat, cattle or some other product, and at the same time we are consumers of sugar, prunes, or a number of other products. We are also consumers of manufactured articles such as boots, shoes and clothing. We all have something to sell, whether it be produce or labor and we all must buy something. We live by exchange of produce.

The distinction between the two classes—consumers and producers—is in the abstract. When you have something to sell you immediately adapt an attitude of mind that is such that you will obtain as great a price as the consumer is prepared to pay. On the other hand as soon as it is necessary for you to make a purchase your attitude of mind changes completely, and you wish to purchase the article at as low a price as possible. The distinction between producers and consumers is largely one of mental attitude.

If you can imagine a pioneer farm fifty or sixty years ago in some part of Ontario, we will find that to a very large degree the owner produced sheep from which he obtained the wool to make clothes for himself and family. He possibly also built his own house. If he had bacon to eat, it was prepared from pigs raised on his own farm. If he had bread and butter, they probably were produced on the home farm. The farmer, to a large degree, was a self-sufficing individual. The communities also were largely self-sufficing. They produced within their own limits practically everything they required. A small amount of money was all that was necessary to purchase outside produce, and very little was sold outside of the community.

Let us go to the opposite extreme. Imagine for a moment that we are having breakfast in the Hotel Vancouver. The first items on the menu will likely be a choice between grape-fruit, oranges, or some other fruit. The point is how did we obtain the grape-fruit? Someone in Florida, California, or elsewhere produced it. It did not come to us by Parcel Post or by L.C.L shipment. It came to us in a carload of grape-fruit, packed in boxes of equal size; all grape-fruit in the boxes were of the same size; it came to us in a carload as a standardized article. The bacon that is served very likely was produced either in Saskatchewan or Alberta, and cured either in Calgary or Vancouver. The bread, from which the toast was made, was possibly made from flour produced in either Saskatchewan or Alberta and milled in Vancouver or elsewhere. The butter may have come from New Zealand or Alberta. With the exception of possibly the eggs, milk and fish no other article on the menu was produced in or near the City of Vancouver.

I have gone to the two opposite extremes. Compared to the self-sufficing system mentioned previously we are to-day living under the commercial system. Food supplies are obtained from all parts of the world. We who have produce to sell are in competition in world's markets.

As far as agricultural products are concerned, it is the purpose of the farmer producer to keep filled one large imaginary store-house with produce that the consuming public demands. If this store-house is filled to over-flowing, prices fall; if it is underfilled, prices rise very rapidly. The farmer, or his marketing agent has to be in a position to judge the probable quantities of any product the consumers will demand in given time.

Some time ago there appeared in "The Country Gentleman" an illustration which emphasizes very clearly the main point it is desired to emphasize. The illustration showed three squares side by side, the one at the left, white in colour, representing the producer; the one at the right, white in colour, representing the consumer; the centre square was blackened, and under the illustration was asked the question "What happens in between?"

Let us take the marketing of apples as an illustration. The grower assembles his fruit at a packing house. This is the first step in marketing, and is the first marketing service which someone has to pay for. The packing-house grades, packs and loads. These are the next three marketing services which someone has to pay for. Someone must finance the undertaking, and someone must store a certain portion of the produce. These are the next two marketing services that must be rendered. Finally the apples must be sold; this is another marketing service. If shipped in quantities the cars may be sold by a broker, he in turn distributing to a wholesaler, who in turn distributes through a jobber(not always) to a retailer—the retailer selling to the consumer. Each step is a marketing service that someone has to pay for. The man who performs the service is considered a middle-man, and he is entitled to a fair remuneration for the service he renders.

Under the commercial system of to-day, these services are demanded by the selling and by the consuming public. Criticism of the middle-man is sometimes justified; but we should first consider whether or not he is rendering a marketing service, and then direct the criticism; not at the indivdual, but at the type of service he may be rendering. The service is essential.

Three marketing systems are recognized at the present time:

(1) The direct method. Under this system the producer of a certain article sells direct to the consumer of that article. It may be on an open city market, or it may be by Mail Order. At any rate the two—producer and consumer—must come in direct contact, either personally or by letter or telegraph.

A few producers, particularly of certain vegetables and small fruits, are still of the opinion that more money is to be made by marketing in this manner than by selling through the local associations. Undoubtedly a few men have obtained very fair returns for their produce in this manner; but it is a physical impossibility to handle any great quantity—certainly

not more than 5 p.c. of the produce can be handled in this way.

Wheat, cattle and certain other farm produce cannot be marketed in any part by the direct method, and the opinion is expressed that the few products that are now marketed to some degree in this way would be better sold through the local associations.

(2) The second system of marketing is through the regular channels; that is, by encouraging private middle-men to perform the marketing services. Under this system the private middle-man performs the service of assembling, and expects wages for the service rendered; another middle-man does the processing, and expects wages for the service rendered; another man does the grading, and expects wages for the service rendered, and so on to the broker, wholesaler, jobber and retailer, each one in turn being paid for the service rendered, and possibly also paid a fair profit on the transaction. This is the way business is done ordinarily.

(3) The third system for want of a better name may be called "The Integrated System". (From circular by Dr. Macklin, University of Wisconsin). This is the system used very largely by the large packing companies. No one company in particular can readily be referred to; but the methods are sufficiently well known to us all to give a fair understanding of the situation when their methods are commented on. The packing company may send its representative into the country to purchase stock. This man assembles at a shipping station. The company slaughters, processes, chills, stores, finances and sells. The company may sell through the regular channels, but more likely will follow the practice of some of the American companies, and establish local distributing houses in some of the larger cities; these in turn distributing to dealers or retailers.

In British Columbia a packing company performs every service from the purchase of the animal on the farm to the cutting up of the animal as pork or beef in the retail store. And it may me argued that the company reaps a profit on each of the marketing services; or it may be argued that by sacrificing the profits on one or two of the marketing services the work can be performed more cheaply and efficiently. This, undoubtedly, is the cheapest way of marketing, but makes it impossible for the small packer, small retailer or small business man in many cases to compete with the larger organization. But the system is efficient. This is the system that is employed also by some of the large co-operative associations, only in a lesser degree, for instance, the leading fruit shippers association of this Province. Fruit growers must assemble the fruit at the packing house. The fruit is graded, packed, loaded, financed, stored and sold either by the local association or by the selling body appointed for this purpose. In one case also brokerage firms have been established by the growers in some of the leading cities in the Canadian Northwest. In other words, they are employing to some degree the method employed by the packers. The largest milk producers association may be taken as another example. In this case all services are performed by the association from the assembling of the milk at the shipping station to the delivering of the milk to the cities of New Westminster and Vancouver.

The greatest difference, however, between the packing companies and the associations mentioned is that in the first case a few men who own stock in the company are paid dividends, and may make comparatively large profits, whereas in the second instance all profits go directly into the pockets of the original producers of the article. At the same time the consumers are saved tens of thousands of dollars because of the efficient rendering of the marketing service. Such concerns properly controlled undoubtedly render the public valuable service.

It should be pointed out that middle-men have no invested interests. They perform services, and are paid for them. When they no longer render efficient services they are forced out of business. The same applies to the original producer. If your money is invested in the production of sugar beets, and sugar can be produced more cheaply from sugar canes, you are the loser. This seems to indicate some conflict between personal interest and general social interest; but it should be recognized that the individual is usually sacrificed to the public interest in so far as business is concerned.

The above, I believe, sets forth in a few words the general business principles underlying co-operative marketing. The association to be markedly successful should control 75 p.c. to 90 p.c. of the product; and growers must be persuaded that from three to five year contracts are not only in the interests of the association, but in their own interests also. The business can be organized on economic lines only when the product is guaranteed over a stated number of years. The business must be so organized that prices are stabilized and home markets are to a fair degree controlled in so far as open competition will permit by the original producers of the product. This protects both producer and consumer. The strength of the successful associations of today is found no less in the delivery of a standardized product at lowest possible cost to the consumer than in the cash returns to the original producer due to large and efficient business organization.

I have tried in a general way to show:

(1) That by using the integrated system of marketing there is a possibility of reducing the profit on the marketing services or performing them at cost.

(2) That under the commercial system of to-day it is a large volume of business with one over-head that to a great degree makes possible efficient marketing. This does not infer monopolistic control.

The farmer is entitled to the same rights and privileges as other business organizers of the country. By exercising these rights through an efficient marketing system he is in a position to render a large service to himself and the consuming public. The consuming public is demanding the standard products at a lower price.

DOMINION ELECTION.

Ballots were mailed to every member of the C.S.T.A. on Saturday, April 9th, and the time for the return of these expires on April 30th. On May 2nd, at Ottawa, these ballots will be opened and counted by Mr. Ronald Hooper, Honorary Secretary of the Proportional Representation Society of Canada, who will be assisted by the Honorary Secretary and General Secretary of the C.S.T.A.

The results of this election, giving the names of the new President, First Vice-President, Second Vice-President and Honorary Secretary who will take office at the June Convention, will be promptly announced through the Associated Press.

Pomological Progress in New Brunswick

A. G. TURNEY, Dept. of Agriculture, Fredericton, N. B.

My knowledge of the development of fruit growing in New Brunswick dates from February, 1910, at which time I became horticulturist for the province, coming there from Ontario, and the information I have on the subject is from such records and evidence as I have been able to secure, and which, I regret to say, are very incomplete. They are sufficient, however, to show that the history of fruit culture in New Brunswick, up to the beginning of the twentieth century, is very largely the history of the work of one man: Francis P. Sharp.

He was the leading pioneer pomologist of New Brunswick and perhaps of all Canada. Born at Northampton, in 1825, he removed to Upper Woodstock in 1844, which was to the end his home and the basis of all his operations. He at once commenced a career of discovery and experiment in fruit culture which was destined to become of much value to the province. A belief was general at this time that New Brunswick could not grow successfully apples of fine quality. Sharp obtained scions from Canada, Bangor, Maine, and England, and it is said that he tested about every known variety of apple of approved quality that could be readily obtained. The Fameuse and Alexander had been previously introduced at Fredericton but Sharp brought both into general use, and was the first man to introduce most of the standard varieties to the province, records at that time showing the importation of such other old standard varieties as Red Astrachan, Porter, Minister, Golden Russet, Ribston Pippin, St. Lawrence, Gravenstein, Talman Sweet and Williams Favorite—all prior to 1858.

Sharp must early have become aware of the possibilities in the direction of deriving new and more suitable varieties from seed for among the older seedlings there were several of excellent quality, such as the "Peabody Greening," and "Honey Pink," both of which he propagated and always recommended. Besides, we have the record of purchases of seed, one lot from Fredericton and another from a nurseryman named Dunning, at Bangor. These seeds, to be sure, were for stocks to bud on, but the seeds for which he sent away were intended to be those of improved varieties, for budding purposes and also to test for new varieties.

The native seedling might show, in its first year's growth, an appearance less "crabby" than would be the case generally and it could be quickly tested by top-grafting. This is just what did happen. From the lot of seed received from Bangor grew one seedling which, on account of its appearance was allowed to stand over in the nursery until its second year. It was taken apart and put upon an older stock. When the first fruit came, ten or a dozen fine large, handsome apples, Sharp saw at once their value and began propagating immediately. It was the first apple of quality that gave evidence of being completely adapted to New Brunswick. This was the origin of SHARP'S NEW BRUNSWICK APPLE, exact date not given, but in the early fifties, which many have seen fit to regard as the Duchess of Oldenburg, a variety of Russian origin. Sharp, in 1882, after comparative tests, pointed out some of the differences. However, the knowledge that the "New Brunswicker" was the product of seed grown in the soil of New Brunswick, gave an impetus and direction to a great deal of Sharp's life work.

At what date we do not know exactly, he commenced trying to produce better varieties by hybridizing. With "New Brunswicker" as one parent in most cases, he made in all upwards of 2,000 crosses from which such varieties originated as Woodstock Bloom, Munro Sweet No. 1, Munro Sweet No. 2, (now Walden, a fine apple midway between Fameuse and McIntosh Red), and Crimson Beauty (originally named Early Scarlet). The latter was planted in orchard in 1887, after seventeen years observation in fruiting, so allowing not less than four or five years more, the date when this variety was first begun was certainly as early as 1866. The Munro Sweets, being planted in 1866, the date of their origin would also be about the same. Anyhow, Sharp stated in an address to the Farmers' and Dairymen's Association at Fredericton in 1896, that he and Peter M. Gideon were the "first two men in America to scientifically hybridize the apple and pear." So, whether Sharp or Gideon was actually the first in America, Sharp was certainly by many years the first to begin this important branch of horticultural work in Canada. Unfortunately for the success of his work, the greater part of these crosses were undergoing test in his son's orchard, when that orchard passed into the hands of strangers, who immediately chopped them out, evidently not appreciating the irreparable loss thus occasioned.

To the development of those experiments, and their results, space will only permit of the briefest possible reference. Under his guiding hand orchard after orchard arose on the sunny hills that flank the river St. John. The first one was set out in 1844 with 100 trees, the next at Northampton had 1,000 trees, the third at Jacksonville, 1,600 trees, the fourth at Woodstock, 320 trees, the next was the Stoddard orchard of 2,400 trees, then at Northampton an orchard of 2,560 trees, then the Birmingham orchard of 200 trees, then the orchard, the remains of which now adjoin Mr. Sharp's old home in which there were in 1891, of plums and apples, about 9,000 trees. Later Mr. Sharp and his son, Franklin, established a large orchard at Sisson Brook, a short distance above Woodstock, which was added to from time to time, and in 1891 covered about 100 acres, and comprised no less than 20,000 trees.

But by far the largest branch of this immense business was the nurseries and it may come as a surprise to some to learn that Mr. Sharp succeeded in raising nursery stock so far north in very large quantities. His first nursery was established in 1844 and comprised 4,000 trees; then came others of 28,000, 50,000, 100,000 and 200,000 trees. In 1882 Mr. Sharp and his son founded a nursery on the intervale of 180,000 trees, followed by another of 150,000, but owing to the freshets the location proved unsuitable.

While the early commercial orchards we have spoken of were coming into bearing, the nursery business increased so rapidly that Sharp took in his brother-in-law, Sperry Shea, as partner. During the seventies they did a large business all over New Brunswick, Prince Edward Island, and Eastern Maine. At this time, also, he stocked with root-grafts four nurseries in

Albert County, and the Merritt Nursery at Houlton, Maine. In 1875 they were shipping trees to Massachusetts. In 1879, two carloads went to Manitoba, and about the same time their trees found their way into orchards in New Jersey, New York and Ontario.

In 1885 or 1886 Sharp took his son Franklin into partnership and in 1887 made over to him the Woodstock Nurseries. At that time an inventory showed 600,000 apple and plum trees in various stages of propagation. It is to be noted that while their lists show different varieties from time to time, the list of trees recommended was never large, and contained only those varieties which they had tested fully in orchard. It is interesting to note that McIntosh Red were recommended in 1882, at the same time as Wealthy. The Dudley apple was introduced shortly after it was originated near Presque Isle, Maine. This apple was a seedling obtained from seeds planted by the little daughter of John W. Dudley out of a New Brunswick apple tree presented to her by one of Sharp's agents. When a Rochester firm bought the tree and exploited it under the name of "North Star", it was Sharp who sent his son to Dudley's place and proved the right name to be Dudley. The American Pomological Society took action accordingly by rejecting "North Star" as the name of this fine apple. We also find such native varieties as Peabody Greening, Honey Pink, Summer Harvey, and Kennebec Sweeting, and later several of the Sharp hybrids.

Franklin Sharp displayed exceptional talent for horticulture, and would have made a high mark in putting into practice his father's discoveries, had not his untimely death occurred in 1892. By direction of his will the nursery business was then closed out, ending the work of propagation and introduction of varieties along the lines of tests employed by the Sharps.

The earliest records we have of apples going to market are in 1859. About this date Sharp was shipping to Grand Falls and St. John, and there was an order from Ireland. These were for Fameuse, in part, if not wholly. In the local newspapers, prior to this date, were to be found advertisements of "New York Apples" on sale at Fredericton. The first strictly commercial orchard consisted of an acre of New Brunswickers on the rear of the river slope of the Adam Sharp place in Upper Woodstock. This orchard, planted before 1860, is still producing annually.

The success of the New Brunswicker in the Sharp orchard led to other orchards being established near Woodstock. Three of these in particular, known as the Fisher, Winslow and Stoddard orchards respectively, were planted by Sharp under a rental system and are said to have proved immense producers. The Fisher orchard of two acres planted in 1863, produced in its fifth year 100 barrels per acre, and from its 7th to 17th year averaged 150 barrels per acre. These trees are now 16x16 ft., but may have been closer at the start. However, the Winslow orchard, of one acre, was set very close, 6 x 6 ft., and for 15 years was kept in place by repressive summer pruning. The Stoddard orchard, 2 acres, was planted about 1870, 6 x 6 ft., and similarly pruned. These close set orchards were fenced close to the trees, a roadway along one or two sides being left, and the fruit when packed was hauled by horse and drag to the road. They were remarkably productive orchards, but required that attention in pruning which Sharp himself confessed only those having a talent for horticulture were qualified to give. But 16 feet apart he did recommend as the maximum distance, since he found the apple inclined to dwarf in cold countries and the varieties such as fall into very early permanent bearing. Nor were the successful orchards confined to those thus controlled by Sharp. The Raymond Orchard, near Woodstock, consisting of 3 acres of New Brunswickers, is still producing. The Hon. David Irvine, of Knoxford, in the extreme north of Carleton County, had several acres of New Brunswickers, Alexander, Fameuse and Wealthy that were very profitable. By the year 1887 the county alone was producing sufficient for an export of upwards of 18,000 barrels, practically all of which the Sharps handled.

Franklin Sharp's first work was the establishment of an orchard of 18,000 apples, consisting of 12,000 Crimson Beauty, nearly 6,000 Wealthy, and the remainder of trial varieties with some of the earlier productions of his father. These covered about 60 acres and were planted 8 feet apart, in rows 24 feet apart. Later he doubled up many of the orchard rows, making groups of three rows 12 feet apart, with alternate spaces 24 feet. Under the system intended, these trees, although very free growing in nature, would never have crowded. This was to have been, indeed, a great model orchard. After his death, the father being now out of active orcharding, conditions were unfavorable for the carrying out of any but ordinary modes of culture, and some years later, after the orchard was beginning to produce upwards of 3,000 barrels, the larger portion of it passed into other hands, and right methods not being applied, the orchard, although of the hardiest varieties, went to pieces, at a time when with the proper care, it should have been producing 10,000 barrels a year.

After the Sharps thus went, as it were, out of extensive orcharding, the business of handling fruit in the county passed into other hands that did not maintain the former high standards of packing, and the business declined accordingly.

This brings us to what may be called the second stage of the history of apple culture in New Brunswick —a period marked by a feeling that commercial apple growing, in such a northern climate, was not a practicable proposition. It is easy to see how this belief originated and gained strength. With the advanced age of Mr. Sharp and the death of his son, Franklin, there no longer remained the necessary knowledge and skill to bring to a successful issue such intensive methods of apple growing as they had originated and practised. The orchards which they themselves had planted and controlled fell victims to neglect and wrong handling, while throughout the middle and southern portions of the province these closely planted orchards of early varieties, which had had their source in the Sharp nurseries, came into bearing with no provision for co-operative handling or cold storage shipping facilities to dispose of the perishable product. The resulting large gluts on the small local markets so lowered prices that there was little if any profit in marketing their apples or caring for their orchards and this fact, coupled with the unsuitability of Sharp's methods of intensive pruning and culture to application by the average farmer, led to their neglect. Many of the orchards have passed out of existence but some yet remain, still bearing fruit and are evidence of the facts and conditions as stated above.

Following the closing out of the Sharp nurseries,

agents from Ontario and United States nurseries worked through the province and sold thousands of trees of varieties unsuited to our conditions and the failure of these trees afforded additional proof to many of the impracticability of commercial apple growing in the Province.

This then was the condition at the time of my appointment, except for the example of a very few individuals whose happier selection of varieties and practise of methods of orchard culture more adapted to application by the average farmer, were meeting with success. The work of these men plus the encouragement and attention given by the Government to the development of fruit growing during the past decade, have re-established the practicability of profitable apple production more firmly than ever; they constitute the third stage in our pomolcgical history and they are directly responsible for the steady increase in the area planted to orchards.

Concerning the C. S. T. A. and Its Branches

BY THE GENERAL-SECRETARY.

From the programme on page 162 it will be seen that the sessions of the coming Convention are to be devoted mainly to a consideration of business matters, many of which are of a particularly important nature. This is as it should be. The C.S.T.A. has been an organized society for one year, a year devoted mainly to the formation of provincial and local branches and to the establishment of "Scientific Agriculture" as the official organ of the Society. With these two lines of progress completed, the road ahead is an open one, and at the end of that road, as the goal to be reached, are the larger objects which the C.S.T.A. was brought into existence to accomplish. Future progress will be greatly facilitated through organized branches and through the publicity channel provided by "Scientific Agriculture."

Those who have already joined the Society, and who now number five hundred and fifty, should be satisfied with the progress so far made and be willing to continue their direct support—moral and financial—in the new year soon to commence. Some criticism has been made of the amount of the annual fee, and time must be given to a consideration of that question at the Convention. Looking at the matter from behind the pages of the C.S.T.A. cash books, the writer is in a position to know whether any immediate reduction in the annual membership fee is possible.

Starting last June, the Society had a credit balance of $1,426. This was more than wiped out by the payment of delegates' expenses to the organizing Convention and other convention expenses, and the first year of the C.S.T.A.'s existence began with the organization in debt. That was in June, 1920. At the same time we learned that the Dominion Government was unable to give the Society the financial assistance that was expected and which was to have taken the form of a $2,500 grant to cover organizing expenses.

During the present year the General Secretary has received $1,600 in salary, the subscriptions of 550 members to this magazine have been paid, the General Secretary has travelled from one end of the Dominion to the other in connection with provincial organization work, and the expenses of considerable postage, telegrams, printing and other items have been met. And yet we still have a small credit balance! Where has the money come from?

It will be the pleasure of the General Secretary and the Chairman of the Finance Committee to answer that question in Winnipeg next June. At this moment, this much can be said, that the Society has weathered a very severe financial storm, mainly through the staunch support it has received from its members. Is it advisable to openly combat another similar storm by an immediate reduction of the annual fee? Is it reasonable to suppose that many members will refuse to pay ten dollars per annum to an organization which is national in scope, which will be able to finance the operations of thirteen branches on a ten dollar fee, which gives its members what may be considered a creditable official organ, and which is already welcomed in the United States and Europe by other scientific bodies and publications?

A reduction of the annual fee might be possible in 1922 if no Convention is held and if other operating expenses are reduced to the lowest possible figure. That will be decided this year at Winnipeg. In the meantime the ten dollar fee will probably have to be maintained and the members must remain with the Society and do their share in advancing a much-needed institution.

Alberta Branch.

At a meeting of the Alberta members held at Edmonton on March 18th, the present officers of the Provincial Branch were re-elected and it was decided to hold a provincial "rally and get-together dinner" during the week of the Spring Show at Calgary. Accordingly a dinner was held in the Board of Trade rooms, Calgary, on April 6th, for the consideration of provinceial activities, appointment of delegates, etc.

Mr. H. A. Craig, Deputy Minister of Agriculture, presided. He assured those present that in his opinion much good would be accomplished through the Society and that as long as it confined its operations to the promotion of better agriculture, it should receive the support of every member.

The advisability of forming two local branches within the province—one with headquarters at Edmonton and the other at Calgary—was considered. It was decided to hold the next meeting during the Edmonton Summer Show.

H. A. Craig and T. O. Clark were appointed delegates to the Winnipeg Convention.

British Columbia Branch.

The election of officers for the year 1921-22, in the above branch, has just been conducted by mail ballot, with the following results: President, R. C. Treherne, Entomological Laboratory, Vernon; Vice-Pres., W. Sadler, University of B.C., Vancouver; Secretary-Treasurer, F. E. Buck, University of B.C., Vancouver; Committee, A. F. Barss, University of B.C., W. H. Hicks, Experimental Farm, Agassiz, and G. G. Moe, University of B.C.

New Brunswick Branch.

At the annual meeting held in Fredericton on March 10th, Mr. J. H. King, Moncton, was re-elected President, and Mr. E. M. Taylor, Experimental Farm, Fredericton, was also re-elected Secretary-Treasurer. Mr. A. E. Raymond, of Woodstock, N.B., was appointed Vice-President.

Generous praise was given to *Scientific Agriculture* and the members agreed to support the magazine in every possible way.

Nova Scotia Branch.

At Lawrencetown, N.S., on March 16th, the annual meeting of the above Branch was held. The present officers, whose names are published elsewhere in this issue, were re-elected for another year. Mr. Geo. Sanders, Annapolis Royal, was appointed the official delegate from Nova Scotia to the Winnipeg Convention, and was also named as the N.S. representative on the Dominion Executive for 1921-22.

The members emphasized the importance of seeking the co-operation of the Dominion Experimental Farms Branch, in order that the results of experimental and research work conducted at the various farms and stations throughout Canada might at once be made available to *Scientific Agriculture*. It was pointed out that such a policy would furnish needed information more promptly and in a more attractive and readily accessible form than the restriction of such information to official bulletins and reports.

Quebec Local Branches.

A joint meeting of the Montreal Branch and the Quebec City Branch is to be held at the Queens Hotel, Montreal, on Friday afternoon and evening, April 29th next. The members of the Macdonald College Branch will also be present at the evening meeting. Provincial organization work for the coming year will be completed, and full consideration given to the programme for the June Convention.

There are now one hundred French-speaking members in the C.S.T.A., represented in the two local branches named above.

Northern Saskatchewan Branch.

A meeting of the members of the above branch was held at the University of Saskatchewan on the evening of March 22nd, with Dr. W. P. Thompson presiding as President. Papers were given by Dr. J. S. Fulton on "Laboratory Work on Contagious Abortion," and by Mr. W. A. Munro on "The Work of the Dominion Experimental Farms."

The constitution of the branch was adopted, new officers elected (see page giving C. S. T. A. organization), and nominations submitted for the officers of the new Dominion Executive. Mr. K. W. Gordon was appointed official delegate to the Annual Convention.

Note—A joint meeting of the two Saskatchewan local branches—Northern and Southern—was held at the University of Saskatchewan on Tuesday evening, April 12th, taking the form of a dinner. Addresses were delivered by President Murray, Hon. W. R. Motherwell, Angus MacKay and Dean Rutherford. The dinner was followed by a business session. A full report of this meeting will appear in the May issue.

Western Ontario Branch.

As a result of a meeting held in Toronto on March 10th, the above Branch was organized. Nominations were received for the offices of President, Vice-President and Secretary-Treasurer, and an election was carried out by mail ballot from the office of the General Secretary. This election closed on March 31st, with the following results: President, J. E. Howitt, O.A.C., Guelph; Vice-President, R. S. Duncan, Department of Agriculture, Toronto; Secretary-Treasurer, G. J. Spencer, O.A.C., Guelph, Ont.

In order to adopt a constitution and by-laws, to complete provincial organization work, to appoint convention delegates, and to transact other necessary business, it is probable that a meeting will be held at Guelph on May 3rd, which the officers of the Eastern Ontario Branch will be invited to attend.

Notice to Secretaries of Local Branches.

You should always have on hand a complete list of the present members, of your own branch particularly, with their addresses. The list of members, as of January 15th, was published in the first issue of Scientific Agriculture, and additional names will be found on page 81 of the second issue, page 134 of the third issue and page 179 of the present issue. Changes in addresses will also be found on these same pages.

Editorial Board.

The following have indicated their willingness to act on the Editorial Board of "Scientific Agriculture," and will be consulted, whenever possible, by the Editor. The division of rural engineering has yet to be appointed.

ANIMAL HUSBANDRY.—H. S. Arkell, livestock Commissioner, Ottawa; H. Barton, Macdonald College, P.Q.

BACTERIOLOGY.—F. C. Harrison, Macdonald College, P.Q.; D. H. Jones, O.A.C., Guelph, Ont.

BOTANY.—B. T. Dickson, Macdonald Colege, P.Q.; J. E. Howitt, O.A.C., Guelph, Ont.

CEREAL HUSBANDRY.—L. H Newman, 114 Vittoria St., Ottawa; C. E. Saunders, Experimental Farm, Ottawa.

CHEMISTRY.—F. T. Shutt, Experimental Farm, Ottawa; J. F. Snell, Macdonald College, P.Q.

HORTICULTURE.—F. E. Buck, University of B.C., Vancouver; J. W. Crow, O.A.C., Guelph, Ont.

DAIRYING.—R. W Brown, Agricultural College, Winnipeg, Man.; J. A. Ruddick, Dairy Commissioner, Ottawa.

ECONOMICS & SOCIOLOGY.—L. S. Klinck, University of B.C., Vancouver; A. Maclaren, Brampton, Ont.

ENTOMOLOGY.—Arthur Gibson, Dominion Entomologist, Ottawa; J. M. Swaine, Entomological Branch, Ottawa.

GENETICS.—W. Lochhead, Macdonad College, P.Q.; W. P. Thompson, University of Saskatchewan, Saskatoon, Sask.

VETERINARY SCIENCE.—A. Savage, Macdonald College, P. Q.

Definite duties will be assigned in June, when two men will also be appointed for the division of Rural Engineering.

Applications for Membership.

Albert, J. L. (Laval, 1915, B.S.A.) Exp. Station, Ste. Anne de la Pocatiere, P.Q.

Breckon, W. D. (Toronto, 1906, B.S.A.) S.S.B., Calgary, Alta.

Blair, W. S. Superintendent, Exp. Station, Kentville, N.S.

Champlin, M. (South Dakota, 1909, B.S.), Univ. of Saskatchewan, Saskatoon.

Garneau, O., (Laval, 1913, B.S.A..) Dept. of Agriculture, Quebec, P.Q.

Harrington, J.B. (Saskatchewan, 1920, B.S.A.) Univ. of Saskatchewan, Saskatoon.

Kinsman, F. B. (McGill, 1918, B.S.A.) Lakeville, N.S.

Knight, A. (Ont. Veterinary, 1905, V.S.) Dept. of Agriculture, Victoria, B.C.

Ligouri, F. M., Dept. of Agriculture, Quebec, P.Q.

Michaud, G. (Zurich, 1904, I.A.) 63 William St., Montreal, P.Q.

MacPherson, H. (St. Francis Xavier, 1893, B.A.) Antigonish, N.S.

Peck, F. E. (Cornell, 1906, B.S.) Wolfville, N.S.

Robinson, F. E. M. (Cambridge, 1915, M.A.) Upper Melbourne, P.Q.

Todd, S. E. (Toronto, 1910, B.S.A.) 186 King St. W., Toronto, Ont.

These names, added to those published in the previous issues of *Scientific Agriculture,* give a present membership of 549.

Changes in Addresses.

The addresses given below have been sent in as corrections to addresses previously published:

W. E. Walker (Saskatchewan, 1917) has left the Department of Agriculture at Regina, and is now farming at Rutland, Sask.

L. Therrien, Victoriaville, P.Q.

W. E. Lake (Saskatchewan, 1919) formerly at Mervin, Sask., is now at the Experimental Station, Morden, Man.

Jas. Laughland, (O.A.C. 1910) who for the past four years has been agriculturist for the Mond Nickel Company at Coniston, Ont., has given up that position to take up farming at Guelph, Ont.

J. Auger, (Oka, 1918) moved from Knowlton, P.Q. to Vercheres, P.Q. on April 15th.

A. B. Cutting (O.A.C. 1904) 35 Glendale Ave., Toronto.

La Revue Agronomique Canadienne

Section Française de l'Organe Officiel

DE LA

Société des Agronomes Canadiens

Rédacteur: F. Létourneau.

Notes de la Rédaction

VERS L'ACTION.

C'est la saison des semailles. L'homme des champs, exemple frappant, a dit un orateur, de la volonté et de l'énergie que produit la confiance dans l'avenir, confie présentement la pure semence à la terre éternelle et féconde.

Semeurs des blés qui lèvent, semeurs d'idées qui germent, s'inspirant tous deux d'un profond amour du pays, sont préparateurs d'avenir.

L'idée, la grande et noble idée, que nous avons, il y a un an, jetée dans le sol de la patrie, a germé. Nourrie d'une sève très riche, elle a grandi rapidement. Elle a produit un grand arbre, dont les branches couvrent déjà les neuf soeurs de la Confédération canadienne, résolues plus que jamais de marcher la main dans la main, les yeux tournés vers l'avenir, vers la grandeur nationale.

Cet arbre—vous l'avez reconnu—c'est la Société des Agronomes Canadiens, prête à l'action, prête à marcher, lentement, mais sûrement, sérieusement, vers la réalisation du but qu'elle s'est tracé et que nous mettons encore une fois sous les yeux des lecteurs:

1.—De réunir tous ceux qui s'occupent de science agricole, afin d'accroître, par un travail d'ensemble, bien organisé, l'influence scientifique et pratique de la profession agronomique et de rendre ainsi de plus grands services à l'industrie agricole;

2.—D'aiguiller la profession vers la supériorité;

3.—D'encourager une politique nationale de recherches scientifiques dans l'intérêt de l'agriculture;

4.—De faire octroyer les subsides nécessaires au développement et à la vulgarisation de l'agriculture;

5.—D'arriver à établir une coopération de plus en plus étroite entre tous ceux qui se livrent aux études agricoles afin d'en coordonner les travaux de la manière la plus efficace;

6.—De viser à une entente complète entre les professionnels, comme société organisée, et les diverses associations agricoles du Canada;

7.—De servir comme de comité permanent auquel seront soumises toutes questions se rapportant au progrès de l'enseignement, aux travaux de recherches, de publicité et de propagande, pour y être étudiées, discutées, formulées, recommandées et vulgarisées en temps opportun;

8.—D'exiger que les titulaires, dans les services techniques, soient des compétences;

9.—De publier tout travail autorisé pouvant servir les intérêts de la science agricole.

Voilà nos divers objectifs. Si d'aucuns peuvent être immédiatement réalisés, d'autres embrassent un vaste champ d'action et ne seront atteints qu'au prix, peut-être, de plusieurs années de lutte. N'importe! A la fin, comme disaient les poilus de la grande guerre, nous les aurons!

A vaincre sans péril on triomphe sans gloire!

LE PROGRAMME KLINCK.

Il reviendra sur le tapis à la prochaine convention générale. Il consiste, comme on sait, à délimiter le champ d'action du Ministère fédéral de l'agriculture, des Ministères provinciaux et des Collèges agricoles. Les grandes lignes de ce programme ont déjà été exposées à la convention d'organisation de l'année dernière. Les voici:

Fonctions du Ministère fédéral de l'agriculture

1.—Problèmes nationaux d'administration;

2.—Contrôle de la distribution et des marchés;

3.—Toutes les recherches d'ordre national ou international, y compris celles entreprises pour résoudre les problèmes de commerce interprovincial ou d'exportation;

4.—Règler l'assistance financière à donner aux provinces d'après celle qu'elles donneront elles-mêmes.

Fonctions des Ministères provinciaux d'agriculture

1.—Questions provinciales d'administration;

2.—Tout travail de démonstration;

3.—Prendre la responsabilité des travaux de propagande là où l'on a le personnel voulu, sinon, laisser temporairement cette responsabilité au Collège d'agriculture;

4.—Excepté là où les Collèges d'Agriculture sont sous la juridiction du Ministère de l'Education, le département de l'Agriculture, aidé du personnel du Collège, déterminera le systme d'éducation agricole de la province.

Fonctions du Collège d'Agriculture

1.—*Enseignement*: formation des professeurs, de ceux qui désirent se livrer aux travaux de recherches, des cultivateurs, des membres du personnel administratif ou technique du gouvernement, des journalistes agricoles, etc.;

2.—*Recherches*: en sciences agricoles, en sciences appliquées, non en rapport avec les problèmes essentiellement nationaux ou internationaux;

3.—*Propagande*: le nombre et le caractère des travaux de recherches et d'enseignement devront être approuvés par le Département provincial d'Agriculture ou d'Education.

Ce projet—nos amis de Vancouver le désirent ardemment—sera discuté à la convention du mois de juin. Inutile de dire que la Société compte sur les suggestions de ses membres. Pas besoin d'ajouter non plus que la Revue Agronomique est leur porte-parole.

La Mosaïque de la Pomme de Terre

Par BERNARD BARIBEAU, B.S.A.

Nous avons récolté, l'année dernière, au Canada, 133,831,400 minots de pommes de terre, évalués à $129,803,300. C'est une de nos plus importantes récoltes.

Un grand nombre de maladies — une douzaine au moins — attaquent ce précieux tubercule. La mosaïque est l'une des principales. Elle retient, à l'heure actuelle, l'attention des phytopathologistes d'Europe et d'Amérique. Nous voulons en dire un mot.

Historique et Distribution.

La mosaïque de la pomme de terre, connue en Europe depuis plusieurs années, a été rencontrée pour la première fois en Amérique, dans l'Etat du Maine, vers 1911. Depuis quand existait-elle de ce côté-ci de l'Atlantique quand Orton, le premier, la remarqua, serait difficile à dire.

Cette curieuse maladie, dont la cause est encore un secret de la nature, se rencontre aujourd'hui dans la plupart des Etats de la République voisine et un peu partout au Canada. Elle est très répandue dans les Provinces Maritimes, le Québec et l'Ontario.

Le pourcentage des plants attaqués, d'après une enquête conduite, l'été dernier, dans l'un des comtés de la province de Québec où l'on cultive le plus de pommes de terre, varierait de ½ pour cent à 75 p.c.

Cela prouve son importance et explique l'acharnement des pathologistes à découvrir la nature de ce fléau, plus grave et plus sournois que les sauterelles de la vieille Egypte.

Cause de la mosaïque.

Elle est encore inconnue. Tout laisse cependant croire que cette maladie est de nature parasitaire. Sur ce point, comme sur bien d'autres depuis un siècle, les hommes de laboratoires finiront par faire la lumière. Pourrait-elle, dans le domaine scientifique, venir d'ailleurs?

Orton, Worthley, Murphy, etc., à la suite de nombzreuses expériences, ont prouvé que les tubercules des plants attaqués de mosaïque donnent invariablement naissance à des pieds atteints du même mal. On a greffé des tiges saines sur des plants malades et vice versa et la maladie, dans les deux cas, s'est répandue dans toute la plante. "La contagion, écrit M. C. L. Perret, directeur du champ d'expérience de Merle, France, est démontrée par la greffe de scions malades sur des pieds sains et par la contamination de plants indemnes se trouvant au voisinage de pieds malades. La nature du contagium est encore inconnue. S'agit-il d'un organisme ultra microscopique, d'un virus filtrant ou bien d'un élément susceptible de troubler les fonctions anzymatiques? On ne sait rien pour l'instant."

Apparence de la maladie.

"Les feuilles, surtout les supérieures, sont plus ou moins enroulées et marbrées. Le même limbe porte des taches jaunes à contour irrégulier et des aires verdâtres. Les folioles ont fréquemment un bord sinueux et sont elles-mêmes contournées.

"Parfois, à ces modifications morphologiques s'en ajoutent de nouvelles: raccourcissement de la nervure médiane, laquelle se recourbe et se replie vers la base; forte ondulation du bord de la feuille. Les plantes ressemblent alors au "chou de Milan" et prennent l'aspect de la frisolée." (Perret)

Si, au mois de juin ou vers cette époque, on examine un champ de pommes de terre, de Montagnes Vertes surtout, on y remarque un certain nombre de plantes dont les feuilles ne sont pas aussi lisses que celles des pieds qui les entourent. Le feuillage, au lieu d'être d'un vert luisant et poli, est quelque peu ridé ou plissé. Ce symptôme varie beaucoup. Il est très marqué sur certaines plantes, il l'est moins sur d'autres, mais il est toujours présent et assez pour qu'on puisse le distinguer facilement. En examinant de plus près les feuilles ridées, on trouve qu'elles portent des

Figure 1.

taches d'un vert clair et jaunâtre. Ces taches varient également. Peu visibles au soleil, elles deviennent très apparente quand l'observateur se place de façon à examiner la plante dans son ombre. Les plantes malades ont souvent une plus grande longueur de tige nue. Cela est dû à ce que le feuillage atteint ne s'étale pas et ne retombe pas comme dans les plantes normales, et aussi parce que les feuilles du bas tombent parfois dans la dernière phase d'une attaque violente. La mosaïque se manifestent encore par le rabougrissement de la plante. Dans les cas graves, quand la maladie sévit depuis plusieurs années, la croissance des plants est comme paralysée. Les feuilles se boursouflent davantage et se crispent (fig. 1 et 2). Le champ a une teinte générale jaunâtre.

Les tubercules ne présentent aucun symptôme. Ils se conservent aussi bien que ceux provenant de plantes saines. Le rendement est cependant considérablment réduit. C'est ce que nous allons voir. Nous laisserons parler M. Paul A. Murphy, ex-directeur du laboratoire de phytopathologie de l'Ile du Prince-Edouard. C'est une expérience qu'il a lui-même conduite.

Effets sur le rendement.

Le tableau 1 présente des données exactes sur le rendement des buttes de pommes de terre infectées par comparaison à des buttes saines de la même variété et de la même espèce. Ces résultats ont été notés sur une pièce d'un quart d'acre de Montagne-verte, qui avait été divisée en onze parcelles et employée pour une expérience de pulvérisation. On a constaté, au cours de la saison, que 28 pour cent des plantes étaient attaquées de mosaïque. Un fait intéressant à noter, car il porte sur la fréquence de la maladie, c'est que les plantes employées étaient censées appartenir à une bonne espèce, spécialement réfractaire au fléau. Toutes les plantes malades furent soigneusement jalonnées pendant la saison de végétation. Au moment de l'arrachage, on les enleva une par une et on les pesa avec soin. On procéda de la même façon avec les buttes saines. Voyons un peu le tableau.

Tableau 1. Rendement d'un même nombre de buttes malades et de buttes saines sur onze parcelles de la même famille de Montagne Verte.

Numéro de la parcelle	Nombre de plantes malades	Nombre de plantes saines	Poids des buttes malades (lbs.)	Poids des buttes saines (lbs.)	Pourcentage de production des plantes malades (100 représente la production des buttes saines)
1	66	66	76	121½	62.6
2	71	71	64½	124	52.0
3	62	62	63	116	54.3
4	63	63	75½	130	58.1
5	60	60	70½	113	62.4
6	56	56	61½	112	54.9
7	65	65	68	124½	54.6
8	63	63	66½	104½	63.6
9	65	65	62½	108½	57.6
10	55	55	44	79	55.7
11	56	56	36½	59	61.9
11 parcelles	682	682	688½	1192	57.8
	T - - o - - t	- - a - -	u - - x		Moyenne

On voit par le tableau que les buttes attaquées ont donné moins de 58 pour cent du rendement des buttes normales. Ce résultat est constant. Les limites sont de 52 à 63 pour cent. En d'autres termes, les buttes malades ont produit en moyenne 16 onces de tubercules et les buttes saines 28. Ce n'est pas tout. Les tubercules des plantes attaquéees sont si petits que la proportion de ceux que l'on peut livrer au commerce ne dépasse guère 82.7 pour cent, tandis que la proportion des patates marchandes dans les buttes saines est de 91.6 pour cent. La proportion de tubercules marchands chez les plantes malades n'est que de 52 pour cent de la normale. Si maintenant nous traduisons ces chiffres en minots par acre, nous trouvons que sur une récolte ordinaire de 250 minots à l'acre, la proportion des tubercules vendables est réduite d'environ un minot et un cinquième pour chaque un pour cent de mosaïque présent.

Comme la récolte ordinaire de Montagne Verte contient probablement de 20 à 100 pour cent de mosaïque, la perte varie de 24 à 120 minots à l'acre.

Des observations basées sur un autre groupe de pommes de terre de la même variété dans lesquelles se trouvaient 30 pour cent de plantes attaquées ont conduit à la même conclusion. Les buttes saines pesaient 1,337 livres, tandis que les buttes malades ne pesaient que 892 livres. Dans ce cas, les plantes malades ont donné 59.9 pour cent de la production des plantes normales.

Figure 2.

Quelques méthodes de contrôle.

La mosaïque est héréditaire et s'accentue d'une année à l'autre. Il ne faudrait donc pas semer de tubercules produits par des plantes atteintes de ce mal. La sélection s'impose. L'idéal consisterait à choisir dans le champ un certain nombre de pieds vigoureux, exempts de maladie. Ces buttes, en automne, sont arrachées à part, afin de choisir, encore là, les plus productives. On conserve ces tubercules séparément pour les semer de même le printemps suivant. Rien n'empêche, durant l'été ou à l'automne, de pratiquer un second choix sur le produit de cette première sélection. En agissant ainsi, on créera une famille plus productive tout en écartant la mosaïque.

Il est reconnu que les pucerons propagent la maladie. Il faut les combattre. Le sulfate de nicotine, dans la proportion de ¾ de chopine par 100 gallons d'eau, est le traitement à conseiller. Cet insecticide peut être mélangé avec la bouillie bordelaise. On voit facilement, d'après ce qui précède, que la mosaïque

a une grande importance économique. Elle est très répandue dans l'Est du Canada et elle a été également observée dans l'Ouest.

Le service fédéral de la botanique, fidèle à son devoir, conduit, depuis plusieurs années, sur les fermes expérimentales du pays, des expériences sur cet important problème, qui ne laissseront pas de bouter dehors ce fléau de nos champs de pommes de terre, le plus sournois, celui qui, peut-être, aujourd'hui, contribue le plus à diminuer le rendement de l'une de nos plus importantes cultures.

BIBLIOGRAPHIE:

Orton, W.-A. — Potato Wilt, Leaf Roll and Related Diseases, U. S., Dept, Agr., Bul. 64, 1914.

Schultz, E. S., Folson D. — Investigation on the Mosaic Disease of Irish Potatoes. Jour. Agr. Res. 17: 247-273, 1919, and Transmission of the Mosaic to Irish Potatoes. Jour. Agr. Res. 19: 315-337, 1920.

Gussow, H.-T. — Maladies réduisant la production des pommes de terre. Rap. Div. Bot. F. E. C., Ottawa, 1915.

Folsom, D — Potato Mosaic, Me. Agr. Exp. Sta. Bul. 292, 1920.

Barrus, M.-F. — Rap. Soc. Pro. Pl. de Québec, 1916-17.

Cook, McL. T. — Potato Diseases in New Jersey, N. J. Agr. Exp. Sta. Circ. 105, 1919.

Worthy, E. J. — The Transmission of Potato Mosaic Throuh the Tuber. Science n. s. 42: 460-461, 1915.

Perret, C.-L. — La dégénérescence des pommes de terre, Journal d'Agriculture de Québec, septembre 1920.

Murphy, Paul-A. — La Mosaïque de la pomme de terre. Gazette Agricole du Canada, mai 1917.

Les Agronomes de Districts de la Province de Québec

Par NARCISSE SAVOIE, directeur des Agronomes

Depuis l'automne de 1913, le ministère de l'agriculture a inauguré dans notre province un système de propagande et d'enseignement agricoles par le moyen d'agronomes de districts. Au début, l'innovation n'a pas été beaucoup remarquée du public. Les cultivateurs même des comtés où un agronome avait été placé ne connaissaient pas ce personnage pour la plupart.

La chose était nouvelle alors. Il n'en est plus de même aujourd'hui. L'indifférence des premiers jours a fait place à un intérêt spécial dans le travail qu'accomplissent ces propagateurs des bonnes méthodes de culture.

Pour remplir la charge d'agronome de district l'aspirant doit avoir fait un cours complet d'agriculture et avoir obtenu d'une institution autorisée un diplôme de bachelier ès science agricole, (B.S.A.) Il doit, de plus, avoir fait un stage comme assistant, pendant lequel ses connaissances en agriculture et ses aptitudes à remplir une charge d'agronome sont mises à l'épreuve. S'il montre des dispositions pour ce travail, il est susceptible d'être placé lorsque l'honorable ministre décide d'ouvrir un nouveau district.

Le travail de l'agronome est très étendu. Il doit visiter les cultivateurs pour leur fournir, sur place, les renseignements dont ils ont besoin; faire des conférences sur les sujets les plus en rapport avec les besoins des cultivateurs de son district; donner des démonstrations sur les façons culturales, l'abatage des volailles, la taille des arbres fruitiers, etc.

L'agronome doit aussi organiser son bureau, préparer des articles pour les journaux locaux, répondre aux renseignements demandés par correspondance et recevoir les visiteurs. Ces bureaux sont aménagés, en outre des meubles de bureau ordinaires, de miniatures pour constructions rurales, et d'une série de brochures agricoles distribuées par le ministère.

Mais les fonctions les plus importantes de l'agronome sont celles de l'organisation agricole. Nous vivons dans un temps où chaque classe de la société, chaque commufaire valoir ses droits; l'agronome doit s'appliquer à ce nauté d'intérêts, a besoin d'une bonne organisation pour travail. Il doit se rendre compte de l'état et du fonctionnement de chaque société d'agriculture, ou ocopérative, et de chaque cercle agricole, voir à ce qu'ils soient bien administrés et que les procédures soient conformes à la loi qui les régit. Il doit, de plus, aider à l'organisation des expositions agricoles ou scolaires et des concours tenus sous les auspices des sociétés et des cercles agricoles.

En un mot, toute l'activité que doit développer l'agronome dans l'accomplissement de ses fonctions, tel que visites, les conférences, le travail de bureau, converge vers ce but unique et principal:—*Organiser les forces agricoles de son district pour en retirer le plus grand bénéfice en faveur des cultivateurs.*

Le service des agronomes de districts est sous la direction générale du secrétaire de l'agriculture. Il sert

M. F.-N. SAVOIE.

de moyen de propagation à toutes les branches du ministère. C'est ce que l'on appelle aux Etats-Unis "Extension Service".

A l'automne de 1913, nous avions dans la province 5 agronomes de districts, représentant 10 comtés ruraux. Aujourd'hui, nous en comptons 47, résidant dans leur district et celui du comté de Lévis qui tient son bureau au Ministère de l'Agriculture à Québec. Le nombre de comtés représentés actuellement par un agronome est de 52; nous espérons qu'avant 2 ans tous les comtés ruraux de la province auront leur bureau d'agronome.

La Solution du Problème de l'Azote

Par H.-M. NAGANT, I.A., I.F., Professeur à
l'Institut Agricole d'Oka

On a dit souvent que le fer et la houille sont les deux grands facteurs de la puissance économique et militaire d'une nation. Durant la grande guerre qui mit aux prises les empires de l'Europe centrale avec le reste du monde, un troisième facteur, au moins aussi important que les deux premiers a été mis en évidence: c'est celui de l'azote, ou, pour parler plus exactement, celui de l'azote combiné.

"Il est démontré par la guerre", dit M. A. Bertrand, dans le Bulletin de l'Institut International de Rome, numéro de mai 1918, "que le principe chimique élémentaire, tant des explosifs que des matières alimentaires et textiles, est l'azote combiné, de sorte qu'on ne saurait mieux mesurer l'importance nationale d'un pays, tant en guerre qu'en paix, qu'en tenant compte de sa capacité productive d'azote combiné."

Aussi, malgré que la conquête de l'air par l'aéroplane ait frappé davantage le grand public, on ne saurait surestimer l'importance de cet autre grande victoire, remportée par le génie humain en ce vaste domaine atmosphérique, consistant dans la synthèse des composés azotés en partant de ce gaz inerte et apparemment sans affinités qui en représente les trois-quarts de la masse.

Pour mettre en relief toute la grandeur de cette conquête, nous nous proposons de rappeler en quelques mots le rôle primordial de l'azote combiné en agriculture et dans la fabrication des exlosifs. Ensuite, nous passerons en revue les principales méthodes de fabrication de composés azotés synthétiques, appliquées dans le domaine industriel depuis le commencement du siècle, et l'impulsion formidable que leur développement a reçue sous l'action des nécessités et des préoccupations de la grande guerre. Enfin, comme conclusion, ce qui ressortira tout naturellement, ce sont les avantages immenses qu'il est permis d'en augurer dans l'avenir, pour l'économie en général, et pour l'intensification de l'agriculture en particulier, et cela surtout dans un pays disposant d'immenses ressources hydrauliques comme le Canada.

L'azote dans le règne organique et dans l'agriculture

L'azote est, incontestablement, l'élément principal dans l'élaboration de la matière végétale bien qu'il n'entre, en moyenne, que pour une proportion de 1.5% dans la constitution de la matière sèche des plantes. En effet, les composés azotés forment une partie essentielle de la substance, désignée sous le nom de *protoplasme*, qui est la matière vivante des cellules, dont dépend l'activité, le développement et la multiplication de ces dernières.

Tous les tissus et les organes des plantes n'étant que des assemblages de cellules, plus ou moins modifiées, comme un bâtiment de briques n'est que le résultat de la juxtaposition harmonieuse de celles-ci, il est donc évident que le nombre, l'accroissement, le volume des tiges, des feuilles ou organes quelconque d'un végétal sont en fonction directe de la nutrition azotée, dont la priorité essentielle s'affirme bien avant les autres éléments, indispensables cependant, tels que l'acide phosphorique et la potasse. Car, l'azote réglant la croissance générale de la plante, il détermine, par le fait même, la proportion des autres matériaux constitutifs qui peuvent être mis en oeuvre, aussi peu importe, par exemple, l'abondance de *l'acide phosphorique* et de la *potasse* assimilable que renferme un sol, ces éléments ne deviennent utiles qu'en autant que la végétation peut disposer d'azote.

Le problème du maintien ou de l'intensification de la production agricole est donc, avant toute autre chose, une question de nutrition azotée. Trouver de l'azote à faire manger à nos récoltes, voilà l'essentiel. Après, le reste viendra par surcroit. Il y a bien les problèmes de l'acide phosphorique et de la potasse, éléments indispensables aussi, dira-t-on. Oui, mais la solution en est aisée, comparée à celle du problème azote. Depuis quelques années on a découvert en Afrique et aux Etats-Unis des gisements de phosphates minéraux, qui assurent à l'agriculture un approvisionnement d'acide phosphorique pour 10 ou 15 siècles au moins. Les réserves de potasse, dans le sol, sont beaucoup plus abondantes que celles des autres éléments de nutrition végétale, et les vastes dépôts de sels potassiques solubles de l'Allemagne et de l'Alsace paraissent inépuisables. Mais, n'existe-t-il pas un réservoir inépuisable d'azote dans l'air atmosphérique qui en est formé pour les trois-quarts? Parfaitement! Mais le problème, c'est la fixation de cet élément rebelle à toutes les affinités. Ceci nous amène à parler du

Cycle de l'azote dans la Physiologie

Le cycle parcouru par l'azote dans le règne organique, et particulièrement le moyen de pénétration, dans celui-ci, de l'azote libre de l'atmosphère, ont été et sont encore un des chapitres les plus passionnants de la physiologie végétale.

C'est à une discussion sur ce sujet, entre les savants qu'on pourrait appeler les pères, les fondateurs de l'agriculture scientifique, qu'on est redevable de la création de la "Station expérimentale de Rothamsted", de célébrité mondiale, qui s'identifie avec les noms de Lawes et Gilbert. Sir John Bennet Lawes n'était pas d'accord avec le fameux chimiste allemand Justus von Liebig, concernant le mode d'assimilation de l'azote par les plantes; ce fut surtout en vue de vider cette querelle d'Allemand qu'il s'assura les services du docteur Henry Gilbert, en 1843, pour commencer une série d'expériences méthodiques dans son domaine de Rothamsted. Mais s'écartant bientôt des limites un peu étroites du plan primitivement tracé, Rothamsted devint un centre de recherches générales pour tout ce qui concerne les problèmes de fertilité du sol; et les résultats accumulés durant le long espace de temps, allant de sa fondation jusqu'à nos jours, constituent la plus riche source d'informations connue, concernant les questions générales d'agronomie, pour les savants et les agronomes du monde entier. Cependant, la plupart des découvertes dans ce cycle de l'azote, ne furent faites que plus tard, et successivement, par d'autres savants.

Voici, maintenant, en résumé, les principales données de ce fameux problèmes de l'assimilation de l'azote avec les facteurs de solution qu'il comporte dans la limite des découvertes actuelles de la science.

D'une part, on sait que la source première de l'azote organique ne peut-être que ce réservoir immense, en contenant des masses inépuisables, l'atmosphère gazeuse qui enveloppe notre globe. L'air atmosphérique, ainsi qu'on nous l'a enseigné dans les premiers éléments de chimie, est un mélange de gaz, composé prin-

cipalement d'azote, puisque cet élément, à lui seul, y intervient pour 75.5% du poids total. Un petit calcul nous apprendra qu'audessus de chaque mille carré de terrain flotte une quantité d'azote libre, s'élevant approximativement à 20,000,000 de tonnes.

De tout cela il n'y a guère qu'une proportion infime que d'aucuns évaluent à 0.000.002, qui soit en activité de service dans les élaborations et les dégradations successives des composés du règne organique (végétaux et animaux).

D'autre part on n'a découvert, jusqu'ici, aucune plante supérieure qui soit capable d'assimiler directement l'azote du grand réservoir atmosphérique.

Alors se pose tout naturellement la question. Quels sont les mystérieux intermédiaires formant le conduit, le trait d'union entre l'azote de l'atmosphère et le règne organique? Quels sont les agents présidant aux premières synthèses des composés de l'azote, que seuls peuvent utiliser les plantes de nos récoltes dans la formation du protoplasme de leurs cellules?

Voici les facteurs, jusqu'ici connus, qui expliquent la chose:

1.—On a depuis longtemps observé que les décharges d'électricité à haute tension, dans l'atmosphère, y déterminent l'oxydation de faibles quantités d'azote libre, à l'état d'acide nitreux et d'acide nitrique. Les traces de ces composés, entraînés en dissolution dans les précipitations aqueuses, pénètrent dans le sol où ils peuvent être absorbés par les racines des plantes. Remarquons toutefois que les quantités d'azote combiné fournies de cette façon aux récoltes sont bien faibles; la preuve en est que la moyenne des observations, faites depuis des années à l'observatoire de la Ferme Expérimentale d'Ottawa, indique un total de 6 livres d'azote combiné, contenu annuellement dans les précipitations atmosphériques (pluie et neige) couvrant la surface d'un acre. Elles sont donc absolument insuffisantes pour équilibrer les besoins en azote de la végétation, et les pertes par décomposition, à l'état élémentaire.

2.—Il faut attendre jusqu'en 1885 la démonstration irréfutable, faite par Berthelot, de l'assimilation directe de l'azote atmosphérique par certaines bactéries, lesquelles ne sont que des végétaux tout à fait intérieurs. Plus tard, d'autres savants étendirent le champ des découvertes de Berthelot; citons notamment les travaux du savant physiologiste hollandais, Beyrinck, auquel on est redevable de la description des principales espèces des microbes fixateurs d'azote libre, tels les *Azotobacter*.

3.—Enfin la découverte sensatiennelle, faite incidemment par les professeurs allemands Helriegel et Wilfarth, à la Station agronomique de Bernburg, nous montrent une voie de pénétration, indirecte encore, de l'azote atmosphérique dans l'économie des plantes supérieures appartenant à la famille botanique des *papillonacées*. Ici il s'agit des bactéries spécifiques qui s'accrochent aux racines mêmes du trèfle, de la luzerne, des pois, et vivent en symbiose avec leur hôte; c'est-à-dire qu'en échange d'autres substances élaborées, par celui-ci, elles lui passent complaisamment des composés azotés qu'elles seules sont capables de former aux dépens de l'azote libre. Ainsi qu'on le voit, ce sont surtout les microbes qui fournissent la clef tant cherchée de l'énigme de l'azote dans la physiologie végétale. Une fois introduit dans le règne organique, le cheminement subséquent de l'azote entraîné dans le cycle biologique, où il a une tendance à se maintenir indéfiniment actif, parcourant une série de transformations successives, constamment renouvelées, s'explique assez facilement. En effet, que du règne végétal ils passent dans le règne animal ou non, les composés azotés complexes, lécithines, albumines, protéides, etc., contenus dans les débris des végétaux, où leurs produits de désassimilation dans le corps animal, urée, acide urique, acide hippurique sont dégradés, simplifiés progressivement par les fermentations banales produites par une foule de microbes pour aboutir finalement à l'ammoniaque, dernier terme de simplification d'un composé azoté organique. Dans le sol, l'ammoniaque qui résulte de ces transformations, rapides ou très lentes, selon les circonstances, est repris par les bactéries de la nitrification, qui pullulent dans les terres fertiles, et oxydé, en deux étapes, à l'état d'acide nitrique.

Ces ferments, qui sont spécifiques, convertissent, comme on le sait, l'ammoniaque en acide nitreux et en acide nitrique ensuite, par une seconde étape d'oxydation.

L'acide nitrique, à l'état de nitrate, constitue donc la principale nourriture azotée des végétaux de nouvelles générations, et ainsi le cycle décrit se renouvelle indéfiniment en l'absence de circonstances perturbatrices.

Ainsi qu'il ressort clairement de notre exposé il ne faudra donc pas confondre la nutrition azotée, aux dépens de l'ammonique et des nitrates avec un mode indépendant de l'atmosphère qui en reste l'origine première. L'azote ammoniacale et l'azote nitrique forment, avec les composés azotés complexes encore emmagasinés dans les débris organiques de toutes espèces, humus, tourbe, etc., accumulés à la surface du sol, *le capital roulant d'azote physiologique, ou azote nomade*, comme l'appellent les auteurs, épargne constituée laborieusement durant des siècles de végétation spontanée, grâce à l'introduction continuelle, dans le règne organique, d'azote combiné par l'activité des microbes fixateurs et des phénomènes électriques de l'atmosphère.

(A Suivre)

A PROPOS D'INDUSTRIALISATION

L'argument mis de l'avant pour justifier une politique d'industrialisation, c'est qu'il faut de nouveaux marchés à l'agriculture. On rappelle à ce sujet qu'avant l'établissement de la protection douanière, au Canada, la population rurale émigrait en masse vers les centres industriels des Etats-Unis. Il conviendrait cependant d'observer qu'aujourd'hui, contrairement à cette époque, nos produits agricoles sont en si grande demande sur les marchés européens que les prix en sont réglés plutôt par l'exportation que par la consommation domestique. Pour garder au pays le croît naturel de la population il ne sera donc pas besoin d'industries nouvelles, s'il y a moyen d'attacher à la terre les fils des cultivateurs. Or, nous croyons sincèrement que ces moyens existent. (Olivar Asselin).

UN BUREAU DE PLACEMENT POUR LES TECHNICIENS AGRICOLES.

La science agronomique est le principal facteur de la production agricole. Les techniciens agricoles sont les porteurs de ce flambeau. Ils offrent leurs services et les gouvernements, les collèges, les compagnies, etc., les réclament. Les uns et les autres doivent entrer en relation, s'aboucher. Or, ce contact ne peut être établi d'une façon efficace que par l'entremise d'un bureau de placement. Notre Société l'établira sous peu.

Le Rôle de l'Agronome de District dans le Développement de l'Agriculture Moderne

Par GEORGES BOUCHARD.

Professeur à l'Ecole d'Agriculture de Sainte-Anne-de-la-Pocatière.

Il appartiendrait sans doute à l'un de nos agronomes de souche, à l'un des pionniers de la profession, de retracer l'histoire, ou mieux, l'épopée du travail agronomique à travers les masses populaires souvent hostiles aux notions de l'agriculture moderne. Ceux-là ont ouvert les premiers sillons sur lesquels les agronomes d'aujourd'hui récoltent à pleines mains. Ceux-là ont vaincu les préjugés les plus féroces et ont implanté solidement dans les cerveaux les plus ouverts les premières idées de progrès rural...

L'agronome moderne entre en scène avec des perspectives beaucoup plus encourageantes qu'autrefois. Ravagés par la lutte de nos prédécesseurs, la routine et les préjugés séculaires sont sans cesse tenus en respect par le feu de barrage de nos publications agricoles et de nos conférences publiques.

Il reste sans doute encore bien des positions à prendre, bien des ennemis à refouler, mais, pour retarder l'élan donné, il n'y a plus que la résistance des forces passives. Les agressifs de la routine ont désarmé ou cherchent un refuge dans les coins obscurs d'où le bon sens est généralement exclu. L'évidence même des choses s'impose à l'attention de la majorité de nos cultivateurs avec une puissance toujours croissante.

Ce qu'est l'agronome de district.—En Belgique, où ils existent depuis longtemps, les agronomes de district sont appelés "agronomes de l'Etat"; dans la province d'Ontario, ce sont des "représentants de district"; aux Etats-Unis, ils sont connus sous le nom "d'agents de comté", et dans la province de Québec, où ils sont en exercice depuis l'année 1913, ce sont les "agronomes officiels" ou les "agronomes de district". Quel que soit le nom qu'on leur donne ce sont des hommes chargés par les départements d'agriculture d'orienter les cultivateurs dans la voie du progrès agricole.

La province de Québec compte à l'heure actuelle quarante-deux agronomes de district et près d'une vingtaine d'agronomes-adjoints.

On a une idée du chemin parcouru, quand on songe que les cultivateurs reconnaissent eux-mêmes les services rendus par leurs agronomes et qu'ils contribuent à leur maintien par un bonus annuel qui varie entre $250 et $1,000 par comté.

Agronome et Agriculteur.—Ces deux termes, loin de s'exclure, se complètent et se compénètrent. On a défini l'agronome: *"Un technicien qui étudie la théorie de l'agriculture en vue d'en perfectionner la pratique*. L'agriculteur, lui, exploite un domaine agricole dans le but d'en trer le plus de profits possible. Seuls, alors, les esprits hantés par la suffisance ou un absolutisme étroit, peuvent concevoir l'idée d'opposition entre ces deux classes d'hommes qui poursuivent un même but bien qu'avec des moyens différents. Le théoricien habile et compétent qui sait faire appliquer la science agricole avec tact et pondération est un véritable agronome.

Il faut à l'agronemo beaucoup de jugement pour saisir, comme dirait Labat, cette réalité spirituelle très profonde et très belle qu'est l'âme paysanne, derrière les rudesses concrètes souvent décourageantes qui l'enveloppent et la cachent.

On rencontre des gens qui n'aiment pas la classe agricole parce qu'ils ont été inhabiles à en saisir le caractère. Sous des apparences d'égoïsme, l'âme paysanne recèle des trésors de dévouement, et sous une mine fruste des sources d'émotion très vives. Les qualités maîtresses de la classe agricole sont la prudence, la sobriété, l'économie, la prévoyance, la charité, l'amour du travail, c'est-à-dire toutes les vertus fondamentales nécessaires à la survivance et à la grandeur des nations.

Le premier devoir de l'agronome est donc de bien saisir l'âme paysanne, de comprendre en un mot son "partner", l'agriculteur, afin d'accomplir avec lui une

M. GEO BOUCHARD

oeuvre solide. Il lui faut donc un rare tact, une dignité exempte d'affectation, une affabilité qui exclue une trop grande familiarité. L'agronome doit donc savoir instruire et diriger en égayant et même en plaisant. Il lui faut presque toutes les qualités d'un homme parfait.

L'agronome un initiateur du progrès agricole.—L'observateur, même le moins averti, ne peut s'empêcher de remarquer les progrès rapides accomplis en agriculture surtout depuis la dernière décade. Dans un siècle, sous l'inspiration des hommes de science, grâce aux découvertes de la chimie, au développement de la mécanique, au perfectionnement de nos méthodes d'investigation, etc., nous avons fait plus de progrès que dans dix siècles antérieurs. D'un simple métier de routine et de tradition qu'elle était, l'agriculture est devenue, depuis cent ans, la plus révolutionnaire en quelque sorte de toutes les formes d'exploitation. Si nos grands-pères revenaient au monde, leur émerveillement serait sans pareil.

Mais à quoi donc serviraient tout ce déploiement de science, toutes ces découvertes, toutes ces expérimenta-

tions savantes sans leur application à la pratique. L'agronome est choisi pour aller porter aux cultivateurs l'évangile de la bonne culture; il est un vulgarisateur puissant qui s'applique à dépouiller de leur fatras de termes scientifiques les observations des savants, afin de les transmettre aux cultivateurs sous une forme abrégée et simplifiée.

Au besoin, il ajoute l'exemple ou la démonstration aux paroles se souvenant du précepte des latins: "Longum iter per praecepta, brevis per exempla", l'exemple entraîne plus vite que la parole.

L'agronome, le centre de toutes les activités rurales.—Le rôle de l'agronome ne se résume pas seulement dans des services d'ordre purement technique: il doit s'étendre à toutes les sphères de l'activité rurale. L'agronome est l'impulseur de toutes les sociétés et organisations agricoles. Depuis que les agronomes s'occupent de nos Sociétés d'Agriculture, nous avons vu augmenter le nombre de leurs membres. Les expositions sont également plus fréquentées et mieux organisées. Les Cercles agricoles reprennent une vie nouvelle d'une intensité proportionnelle à l'activité déployée par l'agronome. Les coopératives surgissent comme par enchantement...

Un domaine qui requiert plus spécialement la présence de l'agronome, c'est le marché. A quoi sert aux cultivateurs de produire s'ils n'arrivent pas à trouver des débouchés avantageux? L'agronome doit surveiller les opérations commerciales des cultivateurs afin de les rendre plus fructueuses. C'est par ce moyen que certains agronomes se sont acquis auprès des cultivateurs, une renommée sans pareille.

L'agronome doit surveiller en même temps tous les mouvements sociaux pour les empêcher de prendre une tournure destructive de l'ordre public ou contraire aux intérêts généraux de la nation.

L'agronome, un éclaireur ou un guetteur.—L'agronome prudent, conscient de sa noble mission et de l'importance de ses fonctions, peut rendre des services importants à la classe agricole en la mettant en garde contre certains procédés dangereux ou malhonnêtes dont elle est souvent victime. Autant il doit avoir du respect pour les commerçants de bonne réputation, autant il doit dénoncer à la vindicte publique ces agents véreux qui exploitent nos cultivateurs de la façon la plus ignomineuse. C'est un des premiers devoirs de l'agronome de renseigner les cultivateurs sur les démarches de ces "empliseurs publics," de ces voleurs souvent légalisés qui drainent aujourd'hui, par de fausses représentations, les économies des cultivateurs.

L'agronome a besoin, dans ces circonstances difficiles, d'un tact qui soit à l'égal de son dévouement.

Il devra surtout contribuer à former une mentalité saine qui prémunisse le cultivateur contre ses propres faiblesses.

Comment apprécier le travail d'un agronome.—Ceux qui mesurent l'efficacité du travail accompli par l'agronome de district seulement par les paroles élogieuses ou blessantes qu'ils recueillent sur leur passage, font preuve d'un esprit superficiel. La popularité et l'impopularité ne devraient pas non plus servir de mesure pour le mérite ou le démérite d'un agronome. C'est si facile, dans l'accomplissement d'une tâche sérieuse, de provoquer quelques manifestations favorables ou défavorables. L'agronome, comme me disait un jour le Commissaire de l'Industrie animale à Ottawa, est comme le gérant d'une grande usine, qui est la terre d'un comté. Il doit activer la production de cette usine au point que l'amélioration des résultats en deviennent sensible. Une enquête minutieuse et périodique, poursuivie sur les marchés, dans les fabriques de beurre et de fromage, dans les presbytères où se paient les dîmes, au centre même des associations agricoles coopératives et autres, prouverait mieux l'efficacité du travail d'un agronome que les louanges adressées par un cultivateur ou bien les reproches adressés par une gente à préjugés, ou à desaccords. Peu importe qu'on nous blâme ou qu'on nous loue dans certains milieux, pourvu qu'on a pour soi la confiance d'un groupe sain, progressif, qui ne cède pas facilement à l'influence néfaste des préjugés populaires.

La clef du succès pour l'agronome.—On ne doit jamais oublier que "l'agronome est pour les cultivateurs et non les cultivateurs pour l'agronome." Partant de ce principe, l'agronome de district doit faire preuve d'un dévouement inlassable.

Mais d'un autre côté, il ne faut pas que ce dévouement soit intempestif. Il faut arriver à temps, savoir se faire désirer et savoir s'effacer quand le service offert gratuitement ne semble pas plaire.

L'agronome est un aide gratuit. Il n'a que des faveurs à offrir aux cultivateurs. Voilà pourquoi il doit agir avec discernement. Le dévouement de l'agronome doit toujours revêtir un certain charme de discrétion qui éloigne les importuns et attire les autres. Il doit travailler surtout avec une élite. A rien ne sert de vouloir convertir les foules, détruire bruyamment tous les préjugés et refouler toutes les opinion contraires. "Comprendre, c'est égaler", et voilà pourquoi l'agronome n'est sûr de déterminer l'adhésion que chez un groupe restreint. C'est à lui de se faire des adeptes parmi les cultivateurs progressifs et la masse des autres suivra insensiblement.

L'agronome ou l'agent de comté doit encourager et stimuler toutes les initiatives, favoriser toutes les activités, de quelques sources qu'elles originent, pourvu qu'elles poussent dans la voie du progrès. Pour rendre son travail plus efficace, il doit encore faire appel aux experts ou aux spécialistes des Ministères d'agriculture et des Institutions d'enseignement agricole.

Les Américains des Etats-Unis ont fait preuve de bon jugement en donnant à leurs agronomes le qualificatif d'"agent de comté" (County Agent) pour signifier la part prépondérante qu'ils doivent prendre dans toutes les affaires favorables à la classe agricole.

L'agronome ne doit pas dédaigner les secours gratuits qui lui viennent de la part d'hommes influents du comté ou des spécialistes de l'extérieur. Sans cela il s'exposerait à devenir lui-même empirique ou exclusif.

Finalement l'agronome doit s'appliquer ce mot de Laprune: "On agit plus par ce que l'on est que par ce que l'on dit et même par ce que l'on fait." En conséquence, on devra, pour assurer le succès de notre mission, continuer de donner l'exemple d'une intégrité parfaite, à l'abri même de tout soupçon, d'un dévouement sans borne et d'une activité sereine et inlassable.

Et pendant que se poursuit un si formidable mouvement, nos enfants continuent à apprendre les connaissances les plus futiles, enseignées de la plus futile façon. Ils préparent des examens et des concours, pendant que les autres peuples préparent leurs fils aux réalités de la vie.

L'Agriculture dans le Comté de Bonaventure

Par J.-N. ALBERT, agronome de district.

Le comté de Bonaventure est un des plus vastes de la Province. Sa superficie est de 2,106,681 acres carrés. Il comprend 22 municipalités et quelques postes progressifs de colonisation. Une population de 30,000 âmes, dont 25,000 Canadians-français, l'habite.

Cette grande région se compose en bonne partie de sol arable. Les forêts, couvrant encore les trois-quarts de la superficie du comté, sont très riches en essences résineuses, propres à la fabrication de la pulpe. C'est une richesse pour la région. Son exploitation est relativement facile à pratiquer, vu le grand nombre de rivières, chemins naturels, qui permettent le flottage du bois jusqu'aux scieries et pulperies. Cependant, comme dans bien des parties de notre pays, l'industrie forestière entrave le développement de l'agriculture. Il faut l'avouer: c'est un mal nécessaire.

La partie en culture forme une bande d'une largeur d'environ 6 milles sur les rives de la Baie des Chaleurs, avec, en plus, deux paroisses à l'extrême ouest du comté. Le sol est généralement fertile et le climat propice à la culture. Les légumes, les plantes de grande culture, les pommes de terre—le comté en a récolté, l'année dernière, 1,800,000 minots—et même les fruits y croissent à merveille.

M. J. N. ALBERT.

La pêche à la morue, qui fut, pendant de longues années, la principale industrie des habitants de la Baie, a, petit à petit, fait place à l'agriculture, maintenant l'industrie la plus importante du comté. On compte, dans Bonaventure, 11 fabriques de beurre et 3 fromageries, dont 11 sont coopératives. La production totale de ces fabriques, pour l'année 1919, a été de $105,000. Ce chiffre augmentera rapidement. Le défrichement devient à la mode et un mouvement se fait sentir dans l'amélioration des troupeaux, l'aménagement des étables, etc. Le cultivateur y voit des profits considérables.

Une vague d'émulation coopérative a déferlé sur le comté de Bonaventure. On y compte pas moins de 9 sociétés coopératives paroissiales en pleine activité, faisant des achats et des ventes pour un bataillons de 1,500 cultivateurs, tous membres actifs de ces organisations. Six de ces associations sont en relation intime avec les Caisses populaires, complément indispensable des Sociétés coopératives agricoles. Les Caisses incitent les cultivateurs à faire des économies, leur prêtent des fonds pour qu'ils améliorent leur ferme, fassent leur achat au comptant, etc. Les Caisses populaires appuient financièrement les coopératives paroissiales. Celles-ci ont un début toujours difficile. La question du capital ajoutée au manque d'esprit coopératif chez les cultivateurs, à la lutte qu'elles doivent soutenir contre les adversaires du progrès économique et social, espèces de parasites, qui voudraient tenir le peuple dans l'ignorance afin de l'exploiter, sont autant de difficultés à vaincre, et c'est ici que les caisses interviennent, d'une façon sûre et désintéressée, dans le soutien des coopératives, en leur assurant l'indépendance financière dont elles ont tant besoin, surtout au début. C'est bien beau les grands principes, mais, en pratique, quand le nerf de la guerre n'est pas là pour les soutenir, on périt misérablement.

L'initiative prise par la Société Coopérative Centrale des Agriculteurs de classifier les produits agricoles suivant leur qualité a rendu d'immenses services à la classe agricole. En 1917, alors que nous, de Bonaventure, commençions à expédier des oeufs à la Coopérative, moins de la moitié étaient classés No 1. L'année dernière, nous en avons vendu, par son entremise, 125,000 douzaines et 80% furent classés No 1. Cette amélioration s'est aussi fait sentir dans les autres produits de la ferme, en particulier pour ce qui concerne les animaux de boucherie, le beurre et le fromage.

"On voit par là," écrivait récemment le Dr A.-T. Charron, "l'amélioration considérable qui a été obtenu dans la qualité des produits agricoles, grâce à la classification. Cette amélioration, c'est un acte de justice, justice pour le fabricant dont la compétence ne doit pas être laissée dans l'ombre, justice et féconde émulation entre tous les fabricants, grâce à la perspective de voir leurs efforts publiquement appréciés et honnêtement rénumérés, justice envers le producteur consciencieux qui constate qui ne s'est pas donné de la peine en vain pour fournir aux fabricants une matière première irréprochable sous tous rapports. Le producteur possède le strict droit de recevoir pour ses produits un prix proportionnel à leur qualité et ce prix, il ne peut l'obtenir qu'en autant que ses produits lui sont payés d'après classification."

Le progrès agricole qui se dessine dans le comté de Bonaventure s'accentuera d'années en années. La terre ne manque pas dans cette région éloignée de la Province. Elle n'attend que des bras vigoureux, des bras de colons patriotes, canadiens de coeur et d'esprit, comme ceux que nous avons déjà, pour donner cent pour un, apporter sa part de richesses à la reconstruction nationale.

LES PROGRES DE L'AGRICULTURE DANS LA PROVINCE DE QUEBEC

L'agriculture a fait de rapides progrès en ces dernières années dans la province de Québec. Une bonne part de ces progrès, surtout en ce qui concerne l'instruction dans une industrie qui peut être considérée à juste titre comme l'industrie fondamentale du Canada, peut être attribuée à la loi de l'instruction agricole adoptée en 1914 par le Parlement Fédéral pour remplacer la loi de l'aide à l'agriculture. La loi de l'instruction agricole pourvoit une somme de $1,100,000 qui est distribuée tous les ans entre les neuf provinces canadiennes. La part de la province de Québec est de $271,113, et la répartition de cette somme par le Ministère Provincial de l'Agriculture se fait avec l'approbation du Ministre Fédéral. L'année dernière la somme de $80,000 a été consacrée au collège Macdonald, à l'école d'agriculture de Ste-Anne-de-la-Pocatière, à l'Institut d'Oka et à l'école d'art vétérinaire; $171,113 ont été affectés à l'instruction et aux démonstrations dans presque toutes les branches de l'agriculture, dont $69,000 pour les agronomes et $20,000 pour l'enseignement de l'agriculture élémentaire. Sur ce dernier montant $10,000 sont affectées à l'enseignement de la science ménagère, $8,000 à l'enseignement de l'agriculture dans les écoles rurales et normales et à l'encouragement du jardinage à domicile et à l'école et $2,000 aux installations scolaires pour les enfants. Tout le budget de l'entretien des agronomes de district est prélevé sur l'allocation accordée par la loi. Ces agronomes sont au nombre de trente.

Le rapport de 1919-20 sur le fonctionnement de la loi de l'Instruction Agricole nous montre que la province a fait, en ces dernières années, d'immenses progrès en ce qui concerne les démonstrations sur la culture des fruits, l'entomologie, l'industrie laitière, la fabrication du sucre d'érable, l'apiculture, le drainage, les démonstrations sur les récoltes et la culture du sol, la production des semences, l'élevage des volailles, le jardinage à domicile et à l'école, l'organisation d'expositions scolaires, l'enseignement agricole élémentaire et l'établissement de cours spéciaux pour la formation d'inspecteurs d'écoles et de professeurs d'agriculture. Dans les districts ruraux de la province de Québec, les jardins à domicile, qui sont au nombre de 22,731, remplacent les jardins scolaires conduits par 27,326 jeunes écoliers. Un indice spécial de progrès est l'organisation des cercles de jeunes éleveurs, qui sont l'oeuvre des agronomes de district. D'autres organisations également encouragées sont les cercles de jeunes fermières dans les sections de langue française et les cercles de ménagères dans les sections de langue française et les cercles de ménagères dans les sections de langue anglaise. Ces derniers sont sous le contrôle du collège Macdonald.

Il est à noter que depuis la promulgation de la loi de l'instruction agricole, le total des subventions payées aux collèges et aux écoles d'agriculture de Québec en cinq ans et prélevées sur les fonds pourvus par cette loi, se monte à $483,819.

Ministère fédéral de l'agriculture.
Ottawa, 30 mars, 1921.

LES ECOLES MOYENNES D'AGRICULTURE

L'un des membres de la Société a déjà émis son opinion sur le sujet. On trouvera ses vues dans le "Devoir" du 16 mars. La question est importante. Il est encore temps de la débattre.

COMITE DU BETAIL DE COMMERCE DE L'EST.

Depuis quelques années, la vulgarisation de la science a permis aux éleveurs de l'Est de produire pour le marché, par des procédés plus économiques, des animaux capables de soutenir la concurrence des bestiaux provenant des meilleurs centres d'élevage des autres provinces ou des pays étrangers. Le soin apporté au choix des reproducteurs, l'alimentation plus rationnelle, l'hygiène mieux comprise et mieux appliquée, la vente coopérative, ont fait de l'industrie animale une entreprise qui ne connaît plus les risques des anciens jours. Cependant, en dépit des progrès accomplis, l'élevage du bétail de commerce ne donne pas encore tous les profits qu'on peut en attendre. Cela tient aux conditions de transport et de mise sur le marché.

C'est ce que M. J.-N. Ponton, rédacteur du "Bulletin des Agriculteurs," dont la science, le travail et l'esprit d'initiative ont jusqu'à aujourd'hui si bien servi les intérêts de la classe agricole, a compris lorsqu'il résolut, l'hiver dernier, de former le comité du bétail de commerce de l'Est pour étudier les conditions de transport et de mise sur les marchés de nos animaux. M. Ponton s'acharne toujours à l'étude de nouveaux problèmes et ne se donne de répit que lorsqu'il a mené à bonne fin ses entreprises. Soutenu par le seul désir de faire pour ses compatriotes quelque chose qui vaille, toujours disposé, chaque fois que cela peut servir la cause, à s'effacer après avoir provoqué des initiatives nouvelles, il a aujourd'hui le mérite d'avoir contribué pour une large part à l'avancement de notre agriculture.

En dépit de ses occupations déjà écrasantes, M. Ponton a su éveiller nombre d'énergies pour les grouper autour du principal obstacle au développement de notre industrie animale. Les conditions de transport et de mise sur le marché des bestiaux sont défectueuses. Pour découvrir l'étendue du mal, en chercher le remède et l'appliquer, le comité du bétail de commerce a été formé. M. Ponton a été élu président et M. Todd, de Toronto, secrétaire.

Une première convocation a réuni à Ottawa, en janvier dernier, un groupe de représentants des diverses institutions intéressées à l'industrie du bétail de commerce. Toutes les questions d'ordre général résortissent du comité général tandis que chaque province a son propre comité chargé d'étudier les questions locales. Les comités provinciaux se réunissent une fois par mois et doivent faire rapport au comité central qui, lui, s'assemble à tous les mois.

Le travail accompli jusqu'à date par les divers comités peut avoir une portée considérable sur le développement futur du commerce des animaux. Des démarches ont été faites auprès des compagnies de transport afin d'obtenir des convois à bestiaux roulant d'après un horaire déterminé, à certains jours. C'est là un changement qui évitera bien des ennuis aux expéditeurs et qui permettra aux animaux d'arriver plus vite sur le marché. La rapidité du transport entraîne une grande économie de temps et d'argent.

A l'avenir, le marché ne connaîtra plus l'encombrement qui s'y fait sentir chaque lundi. Au lieu de n'avoir qu'un jour de marché chaque semaine, rien ne sera négligé pour en avoir deux ou trois. Ainsi disparaîtront les risques de perte provenant de l'encombrement à un moment donné.

A la dernière réunion du comité général tenu à Montréal, au commencement d'avril, il a été résolu d'entreprendre une campagne de publicité afin de faire connaître aux éleveurs et aux expéditeurs ce qu'il faut faire pour préparer et envoyer des animaux qui arriveront sur le marché en parfait ordre pour la vente.

Tous ceux qui sont au courant du travail du Comité du Bétail de Commerce de l'Est ne peuvent s'empêcher d'entretenir un grand espoir de voir disparaître bientôt tout ce qui a jusqu'ici paralysé l'industrie des animaux de boucherie.

AIME GAGNON,
Professeur à l'Institut Agricole d'Oka.

LES SECTIONS DE QUEBEC ET DE MONTREAL.

Le 15 mars dernier la Section de Québec tenait une assemblée au cours de laquelle plusieurs questions importantes furent soulevées.

Elle demande—et la Section de Montréal devait l'appuyer quelques jours plus tard—que les constitutions de la Société soient amendées de façon à définir clairement les qualifications requises pour devenir membre régulier ou membre honoraire de la Société.

M. N. Savoie, qui avait été chargé de rencontrer l'hon. Ministre de l'Agriculture au sujet de la résolution adoptée à l'assemblée du 3 décembre relative à l'enseignement agricole dans la province de Québec, met l'assemblée au courant de ses démarches et lui transmet la proposition de l'hon. Ministre: charger un comité d'étudier la question pour ensuite la soumettre à un congrès convoquée à cette fin.

La Section de Québec a délégué à la convention du mois de juin: MM. J. Simard, N. Savoie, G. Bouchard et P. Roy.

Son bureau de direction: MM. J. Simard (président), N. Savoie (vice-président), et P. Roy (secrétaire) a été réélu.

MM. A.-T. Charron et J.-N. Ponton ont été délégués par la Section de Montréal à la convention du mois de juin prochain.

Les Sections de Québec et de Montréal ont émis le voeu que la souscription annuelle soit maintenue à $10.00. On ne fait rien avec rien, et notre Société, qui a beaucoup à faire, a besoin de fonds. Ne lésinons pas là-dessus.

Cinq membres de la Société ont été nommés récemment agronomes de district: MM. Jules Auger (Verchères), Florian Champagne (Frontenac), Anthyme Charbonneau (Joliette), Jean-Baptiste Millette (Matane, division 2) et Elzéar Roy (Maskinongé).

Le Révérend Père Léopold, directeur de l'Institut Agricole d'Oka, dévoué membre de la Section de Montréal, adressait dernièrement la parole, à Frédéricton, devant la Société de Pomologie du Nouveau-Brunswick.

Ses amis des Provinces Maritimes l'ont nommé membre à vie de leur Société.

Les Sections de Québec et de Montréal se réuniront, à Montréal, le 29, dans l'après-midi, à l'hôtel Queen, pour étudier, entre autres choses, le programme de la convention générale.

PAROLES A MEDITER

L'école supérieure façonne le spécialiste. Rien n'est appréciable comme une compétence, et dans tous les domaines. L'agriculture, l'industrie et le commerce en exigent plus que jamais; et la nation en réclame à son tour. L'efficacité de l'enseignement scientifique, voilà un mot d'ordre.—Edouard Montpetit.

VOLUME I. MAY, 1921. NUMBER 5

Scientific Agriculture

L'HON. J.-E. CARON.
Ministre de l'Agriculture de la Province de Quebec.

La Revue Agronomique Canadienne

Canadian Society of Technical Agriculturists

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Gardenvale, P. Q.

Scientific Agriculture

Official Organ of the Canadian Society of Technical Agriculturists
A Magazine devoted to the general advancement of Agriculture in Canada.
Published in the interests of Agricultural Science and Research.

Vol. I. **Gardenvale, P. Q., May, 1921.** **No. 5.**

CONTENTS

Published Monthly by the Industrial and Educational Publishing Company, Limited, Garden City Press, Ste. Anne de Bellevue, P. Q. 'Phone 165.

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Subscription to any address in Canada, the United States, or the British Empire, $2.00 yearly; other countries, postage extra.

Changes of advertisements should be in the Publishers' hands ten days before the date of issue

La Revue Agronomique Canadienne

PAGES 227-236

Canadian Society of Technical Agriculturists

First Annual Convention

Royal Alexandra Hotel, Winnipeg, Manitoba

June 15, 16 and 17, 1921

Questions of national importance will be discussed by leaders in agricultural thought from all parts of Canada.

The Lieutenant Governor of Manitoba, the Minister and Deputy Minister of Agriculture, the Mayor of Winnipeg and President John Backen of the Manitoba Agricultural College, will officially welcome the delegates, members and others in attendance.

All correspondence in reference to the convention programme, matters to be referred to the C. S. T. A. for consideration, reservations, etc., etc., should be addressed:

FRED. H. GRINDLEY,
Royal Alexandra Hotel, Winnipeg, Manitoba.

Make a special effort to be present. Remember the dates, June 15, 16 and 17. Arrange for accomodation.

List of official delegates is published in this issue.

:-: EDITORIAL :-:

THE THRESHOLD.

As one year approaches its end and a new year grows closer, it is interesting and helpful to look ahead, to form a mental picture of work to be done and to anticipate the possible results of that work. Continued experience in drawing such perspectives—looking behind and looking ahead—increases the imaginative power and, in course of time, often enables one to foretell the future with a fair degree of accuracy. By the development of such a faculty, many pitfalls are avoided and many wise judgments made. In the backward gaze we see our errors, the causes of those errors and their results; in our foward view, we must consider the problems facing us and with discretion set about to solve them.

In just such a position the Canadian Society of Technical Agriculturists now finds itself. Those whose particular duty it has been to direct that organization during the past twelve months (the Dominion Executive Committee) will shortly have to consider the problems likely to be met in the next twelve months. Having considered those problems, they must make certain recommendations, listen to the opinions of representative members and turn over to a new Dominion Executive the guiding reins. The new Executive must then commence to conscientiously carry out the wishes of the members, consider their problems and endeavour to solve them. In the case of this particular organization it must also consider the problems of an important industry—Canadian Agriculture—and seek the co-operation of numerous agencies in the solution of these problems.

In the actual performance of its executive duties, the new committee will have its burdens lightened because its personnel, with comparatively few exceptions, will be the same as that which has held office during the year now closing. A sufficient number of changes have been made to admit new thought and new guiding suggestions; those who hold office for a second term will be able to give to the committee the administrative knowledge they have acquired from one year's experience.

The C.S.T.A. is at a critical stage of its history and the year ahead is one in which a definite stand must be taken upon many matters of importance. Above all things the Society must retain its members and maintain their interest. In these days of comparative penury—as regards technical agriculturists—no member can afford to pay a membership fee to any organization unless it concerns itself with problems in which that member is directly interested, and problems which, if solved, will benefit the condition in which that member finds himself placed.

Among the members of the C.S.T.A. there are a number of distinct classes –administrators, research workers, teachers, journalists, extension workers, farmers, etc. Each of these classes has its own problems. To cater to the needs of one particular class and neglect the equally pressing needs of another, is to lose the interest of those in the latter class and lose their membership. Such a result must be avoided and it can only be avoided by the direction of concurrent effort along several lines. This indicates the need for great activity. The Executive of the C.S.T.A. must promptly obtain, from representative classes amongst its membership, a list of problems requiring solution; it must then formulate a policy that will solve those problems; and finally it must press its recommendations with all the forces it can muster. If the ultimate object is justified, the methods adopted in its accomplishment are equally justified. Such questions as facilities for research, salaries, appointments, agricultural policies, etc., have been footballed from one committee to another and from one appealing body to another with little or no result. The C.S.T.A. must ultimately concern itself directly with these questions and the sooner it does so the better for the Society and the better for the members.

Having gone so far, and taken such steps as will sustain the active interest of its members, the Society must then concern itself with the larger problems of Canadian agriculture. These problems interest and benefit the members of the Society as a body and not as groups or individuals. In this field the C.S.T.A. can play a significant part if it chooses to do so.

One of the most important movements needed in agriculture today—having regard to the financial condition of the country and the place that agriculture occupies as a basic industry—is a movement that will link more closely together the scientific and the commercial. On the one hand are the scientists, the men in the laboratories and on the experimental plots, introducing new varieties, evolving methods of eradicating pests and diseases, etc.; on the other hand are our farmers, our government officials, federal and provincial, and many of our colleges, encouraging and introducing better methods of producing, marketing and selling, standardizing grades and packages, etc. There must be a common objective ahead of each of the two

extremes, and surely that objective should be "more profit from the industry." The commercial or business aspects of agriculture have too long been unrecognized by the research man, and probably the reverse condition applies equally. If the research man argues that agriculture is fundamentally a science, the commercial man can reply, with equal justice, that agriculture is ultimately a business. The commercial man may go further and state that unless research takes a commercial aspect and shows a financial or "dollars and cents" objective, it is not worth while.

These are the problems with which the Canadian Society of Technical Agriculturists must concern itself in the very near future. It represents all of the agencies working in the interests of agriculture. If it is not prepared to use the accumulated weight which is thus given to it, it must fail in the accomplishment of any real good. If it undertakes to assert itself it can then answer, without embarrassment, the two logical questions of every member: What can the C.S.T.A. do for me? What can the C.S.T.A. do for Canadian Agriculture?

So much for the view before us. To what extent can the work done in the past year by the C.S.T.A. be of assistance in the performance of the work indicated in the foregoing perspective? That question can be answered briefly and easily. In the efficient performance of any national, provincial or local problem, two essentials are required: organization and publicity. These are the weapons used to mould public opinion, and, after all, public opinion, in a free country, directs policy. The C.S.T.A. has shown its perspicacity by providing itself, during the first year of its existence, with these two weapons. It has formed thirteen local and provincial branches, operating under their own officers. These branches will consider their own problems, and, when advisable, will refer them to the Dominion Executive, with definite recommendations. It has established an official organ, or mouthpiece, through which its activities and policies may reach the public.

It would seem, therefore, that at the present time, the Society may look back upon a year in which splendid progress has been made. The duty of every member is plain; if the Society intends to function, it must have the support of its members. There is no logical ground for criticism at this time. Criticism may be given after the Society has failed in what may be considered the performance of its duty. So far the organization has completed its first year by establishing itself firmly and clearing the road ahead. The first duty of every member, and every sympathizer, is to help to carry the C. S. T. A. along that road, not to place stumbling blocks in its way, and not to stand aloof and criticize when the cause for criticism can be very largely lessened by the critics themselves.

FELLOWSHIPS.

In the conferring of Honorary Memberships and Fellowships the greatest possible care and judgment should be exercised. Nothing will do more to lower the prestige of an organization than the giving of these honours to persons whose merit to them is in the least sense questionable. A Fellowship is the goal at which every member of the C.S.T.A. should aim, and that ambition will be sustained as long as the list of Fellowships is strictly limited to members who have earned the title.

The letters "C.S.T.A." are now known in scientific agricultural circles throughout Canada. The letters "F.C.S.T.A." may appear to be a lengthy appendage, but they should carry great significance in the same circles.

TO THE GRADUATE.

At this season of the year several graduating classes are completing their examinations at the agricultural colleges, and many of their members will soon find themselves in an atmosphere entirely different from that of the classroom and laboratory. They have, during their college course, received a training that should help them to do good service in the particular field of agricultural work in which they have decided to specialize. Those who intend to immediately carry their technical education further, will not enter this new atmosphere, but in the majority of instances the B. S. A. degree will serve as a sufficient appendage for the time being.

These new graduates will receive, from their friends and from the institutions in which they have been trained, congratulatory messages and inspiring prophesies. As temporary encouragement, good wishes are admirable, but as a tangible aid their usefulness is very slight indeed. The factors that are going to play the greatest part in developing the graduate into a good citizen and a successful member of his calling, are the severe, discouraging, opposing forces, or knocks, which he has to meet and overcome in the pursuance of his career. To hold your head up, to grin in the face of opposition, to assume a breath of vision that will permit you to accept another viewpoint when your own is patently wrong, and to keep posted in all that directly bears upon your work; these are the essentials. No man has ever been successful who has not made use of the experience of others, as well as making use of his own.

Canada may well be proud of her graduates in agriculture, and of the calling in which these men are engaged. Give the B. S. A. man a fair chance and he can hold his own against the trained man in any other profession.

Earliness in Wheat and its Inheritance

By W. P. THOMPSON.

Professor of Biology, University of Saskatchewan, Saskatoon.

In previous papers (3, 4) the writer has given the results of studies on the inheritance of the length of the period from planting to ripening in wheat. The date covered the first three hybrid generations of several crosses. In the present paper dáta will be given on the later generations of these crosses as well as on several additional ones and the results as a whole will be correlated and interpreted.

In many parts of the world and particularly in Western Canada a necessary or highly desirable quality of crop plants is rapidity in maturing. The early plant escapes the danger from frost where the season is short. It has also been shown that it escapes damage from rust to a much greater extent than do later varieties. Moreover earlier varieties would extend the area of safe farming much further north. In Australia and India quickly ripening varieties are necessary because of the shortness of the wet season.

The production of quickly maturing varieties through plant-breeding operations should be facilitated by a determination of the mode of inheritance of earliness and lateness. The number of hereditary factors involved, the number of offspring which must be raised in order to recover the parental conditions if this be possible, the correlations between earliness and other qualities, particularly undesirable ones, will very largely affect the success of the practical measures and will determine the most advantageous way in which to carry them on.

DR. W. P. THOMPSON.

Moreover it appears that the conditions in wheat as described in the following pages are probably similar to those in other plants so far as one can judge from the limited information available for other plants. If that be true the conclusions reached may form a basis for work on many different crop plants.

Early Varieties.

In order to make a comprehensive study of the problem a systematic endeavor has been made to secure as many as possible of the earliest varieties now grown, particularly as it seemed that different varieties might owe their earliness to different factors which could be recombined. Hundreds of varieties have been secured and tested from many countries including United States, Australia, India, China, Japan, Siberia, Alaska, Asia Minor, Persia, Mesopotamia, and many European countries. In Table I. a list of varieties is given which have proved earliest in this locality over a series of year Owing to the variations in the length of the period i different years the reckonings have been made from the earliest variety as zero. The figures give the average of several years' results, usually five. No varieties later than Marquis have been included except Red Fife and Red Bobs which have a special interest in Western Canada. All these results were obtained with pure line selections. In many cases notably Calcutta, Sonora, Federation and Red Bobs, it was found that the original samples showed considerable variation in regard to earliness, and gave rise to pure lines with different mean conditions.

No claim is made concerning the completeness of the list. It contains most of those that could be secured through the efforts of many friends and correspondents. Very probably a systematic exploration particularly in Australia, India and Siberia would reveal many others and perhaps some still earlier.

TABLE I.

Variety	Source	Species	Number of days later than the earliest
Nyngan	Australia	T. Vulgare	0
Lambrigg	Australia	"	2
Sunset	"	"	2
Calcutta	India	"	2
Harriet	Australia	"	3
Jonathan	"	"	[illegible]
Chogot	Siberia	"	4
Irkutsk	"	"	4
Khapli		T. dicoccum	4
Prelude		T. vulgare	4
Pusa 12	Pusa	"	4
Tukur	Abysinnia	T. durum	5
Indran C.	India	T. vulgare	5
Wagga	Australia	"	5
Chul	Washington	"	6
Kings White	Australia	"	6
Pusa 4	Pusa	"	6
Pusa 6	"	"	6
Sonora	Washington	"	6
Cedar	Australia	"	7
Federation	"	"	7
Comeback	"	"	7
Pioneer		"	8
Bunyip	"	"	8
Currawa	"	"	8
Ruby	"	"	9
Chinese	China	"	10
Major	Australia	"	10
Bobs	"	"	11
Bishop		"	12
Fretes	Washington	"	12
Marquis		"	16
Ladoga	Alaska	"	16
Red Bobs		"	15 20
Red Fife		"	20

TABLE II.

Days from planting to ripening

Variety	1916	1917	1918	1919	1920
Prelude	107	95	132	112	92
Pioneer		98	137	114	96
Bobs	112	101	137	119	99
Marquis	119	108	141	125	104
Red Fife	135	112	145	128	109
Durun	not ripe	116	145	130	113
Club	not ripe	118	147	134	116

TABLE III.

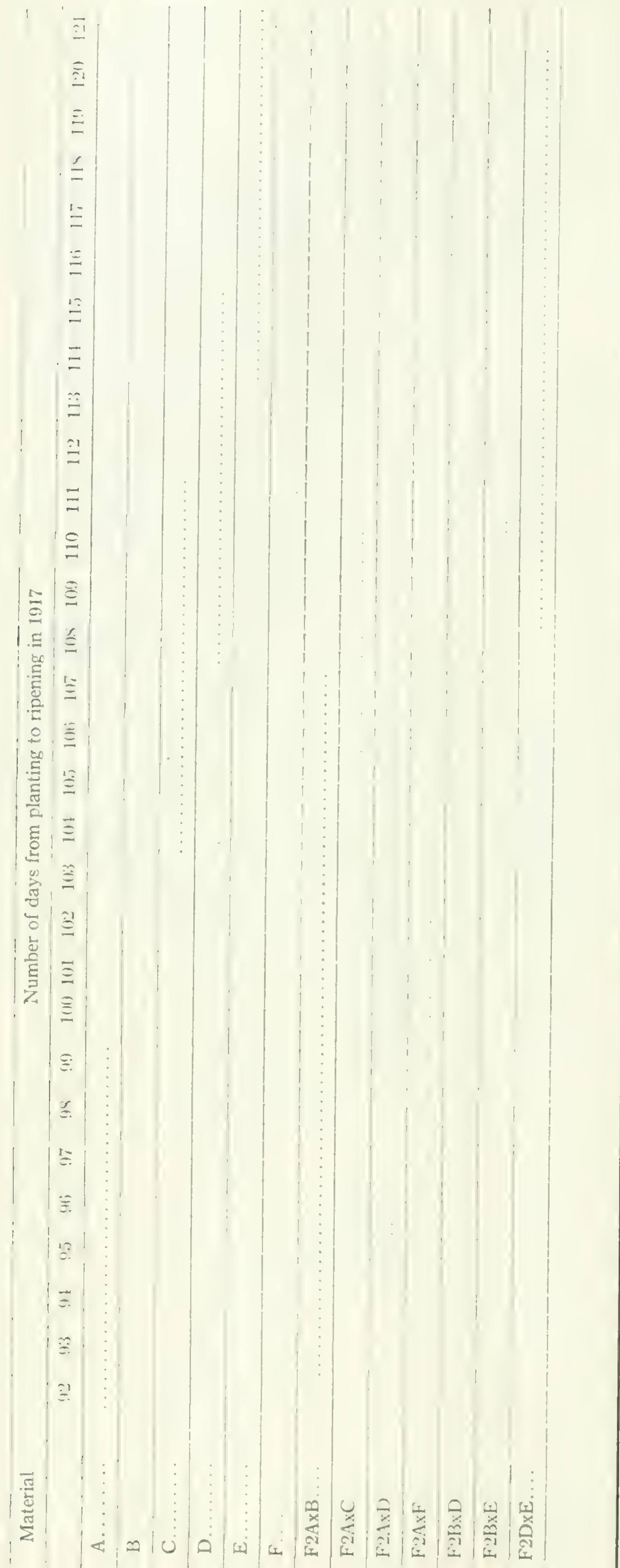
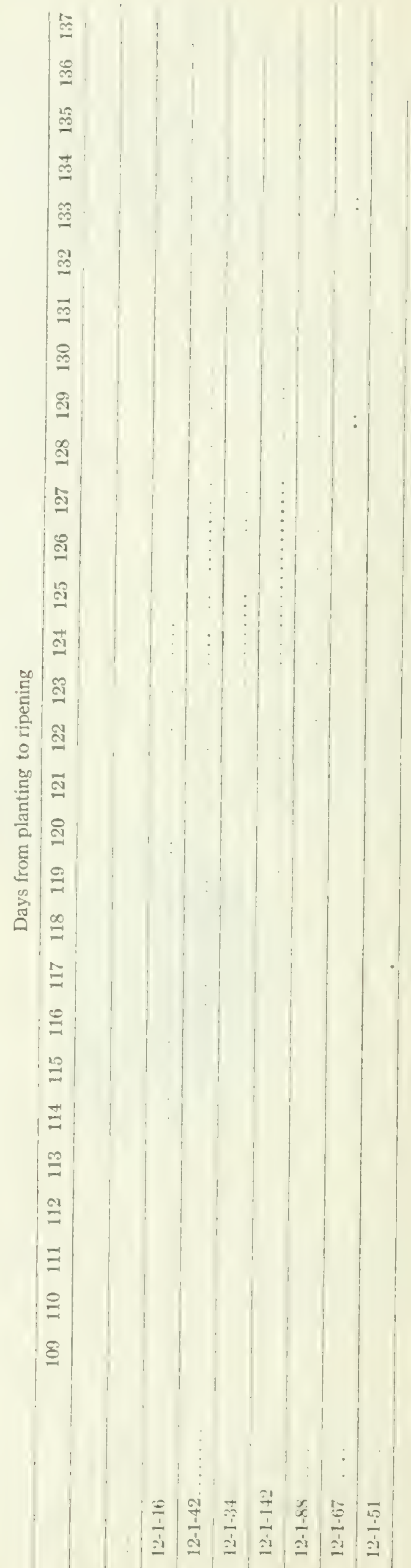


TABLE VI.



The consistently early ones show a great range of characteristics. Not all of them by any means are wholly inferior. Several are now grown commercially in India and Australia. For different reasons none of them could compete with those which we already have except perhaps in districts where the season is very short.

Effects of Environment.

As is well known environmental conditions cause considerable variation in the length of the growing season in different years. In 1918 for example it was for most varieties between 35 and 40 days longer than in 1920. The variations during 5 years are shown in Table 2 for several well known varieties. The difference between any two varieties is, however, remarkably constant, no matter how long the actual growing season may be. There are of course variations in these differences but not as much as one might expect.

The comparative earliness may vary in different localities. Thus Professor Pye of Dookie, Australia, informs me that Minister, which he originated, is there an early mid-season variety while here it scarcely ripens at all. Many other varieties which are later than it in Australia, are much earlier here. The same is true of Firbank wheat. The reports of the Experimental Farms show that in different localities in this country the differences between varieties may vary.

The figures given in Tables 1 and 2 show the mean ripening periods of many individuals in each variety. The time at which the different plants in a variety ripen covers several days; usually it is about a week when soil conditions are uniform (see Table 3). The distribution of the individuals in each variety is in the form of a typical curve of variation.

Scope of Crossing Work.

From Table 3 it will be seen that different varieties ripen at many different times between the extremes of earliness and lateness. When varieties not included in this table are considered it is found that there are all imaginable conditions between extreme earliness and extreme lateness. Crosses have been made between parents differing by only a few days and located at various places on the whole range of variation. Crosses have also been made between pairs of varieties showing all degrees of difference. It should therefore be possible to analyse the whole genetic situation. Several of these crosses have been carried to the fifth generation and as many families of the later generations raised as the great amount of labor involved would permit. Data on a few of the typical crosses are given in the accompanying tables. These particular crosses have been chosen for discussion because they represent various degrees of difference between the parents.

First Hybrid Generation.

In all crosses the first hybrid generation plants were at least as late as the later parent. This cannot be interpreted as due to dominance in view of the results in the second and later generations. It appears to be due to the method of planting. Owing to the necessity of raising as many second generation plants as possible in order to get all possible segregates, the individual first generation plants were grown under conditions which would yield the maximum number of seeds. They were spaced much further apart than under ordinary conditions. This naturally encourages greater vegetative growth and delays ripening, so that the results are not comparable with those for the parents or later hybrid generations.

In this connection it is interesting to note that Tschermak (5) working with peas found that in a cross between an early and a late variety the F_1 were uniformly intermediate. Leake (2) reports similar results for cotton.

Another point to be noted is that the F_1 plants frequently showed increased vigor due to crossing. This leads to greater vegetative growth and may delay ripening. On the other hand East and Jones (1) state that one general effect of hybrid vigor is to put forward the time of maturity. The rapidity of growth of the hybrid more than compensates for the increased size. Probably different results in this respect may be expected with different plants.

Second Hybrid Generation.

In every cross the great majority of second generation hybrids were intermediate between the parents. The range of variation in this generation extended practically from the early extreme of the early parent to the late extreme of the later parent. This is shown in Table 3. The distribution of the plants was in every case in the form of a typical variation curve covering practically the whole range of the parental types and the space between them. There was no heaping of individuals at either of the parental positions (which would indicate dominance with simple segregation) but only in the intermediate position. If the extreme variation with the recovery of the parental types is taken to indicate Mendelian segregation it is obviously not of the simple type involving only one or two hereditary factors. In all cases these results were obtained for at most a few hundred plants.

Perhaps the most striking feature of these results as shown in Table 3 is their uniformity. No matter how small or how great the difference between the parents may be, nor at what region of the general range of variation two slightly different parents may be located, the F_2 curve is strikingly uniform and covers practically the whole range of variation of the parents concerned. The table shows that the more nearly the parents are alike the greater the probability of recovering the extreme parental conditions. This may be due not only to genetic conditions but also to the fact that the necessarily limited number of second generation plants have to be spread over a wider range in the case of wider crosses.

The F_2 of crosses between other pairs of the parental varieties represented in Table 3 were grown in subsequent years. Thus the F_2 of B x C and C x E were grown in 1919, and results were similar to those just described. The F_2 of A x E, the cross involving the widest parental difference, were raised in 1918 and extended to the means of both parents. In that year the parents were not as different as usual owing to the effects of a rust attack. Consequently one cannot be sure that the parental conditions were recovered in the F_2.

Third and Later Generations.

Many third generation families of each of these crosses were grown in 1918 and later generations in subsequent years. Some representative results in the cross A x B (the earliest two) are given in Table 4. The great increase in the number of plants with each generation made it impossible to record individually the plants of the fourth and later generations. But careful observations were made to determine the day of ripening of the first plant in each family and the day when all were ripe. The fourth generation families are therefore represented merely by lines which show the range of variation. Really the fourth generation plants were grown a year later than the third so that the dates given

TABLE IV.

Days from planting to ripening

		126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
A																
B																
AB	12-5-23	4	4	4	3	10	8	3	1							
	12-5-23-3															
	12-5-23-6															
	12-5-23-4															
	12-5-44		1		2	10	8	9	6	8	2					
	12-5-44-7															
	12-5-44-17, 21, 24, 26															
	14-1-14		1	2	1	1		2	4	18	3					
	14-1-14-2															
	14-1-14-9															
	14-1-14-7															
	14-1-14-3															
	14-1-14-11															
	12-4-15			2	4	1	10	1	2	1	2					
	12-4-15-4 families															
	12-4-15-3 "															
	12-4-17				2	5	3	4	1	2	4	3				
	12-4-17-29															
	12-4-17-27															
	12-4-17-25															
	19-1-6					3	2		5	5	9	2				
	19-1-6-3 families															
	19-1-6-5 "															
	12-4-16				2	1	1	4	2	3		2	2	1	1	
	12-4-16-5															
	12-4-16-4															
	12-4-16-8															
	12-4-16-2															
	12-4-49					1	0	5	2	3			6	2	1	
	12-4-49-2															
	12-4-49-13															
	12-4-49-9-															
	12-5-47							2	3	17	19	4				
	12-5-47-5															
	12-5-47-3															
	12-5-47-11															
	19-1-34							4	2	16	6	5	1			
	19-1-34-16															
	19-1-34-27															
	19-1-34-17															
	19-1-34-15															
	12-5-42							2	2	7	9	1	1	3	1	
	12-5-42-4															
	12-5-42-5															
	12-5-42-13															
	12-5-42-25															
	12-5-42-12															
	12-5-42-11															
	21-1-15							4	3	2	8	15	8	2	3	1
	20-1-41								5	3	20	9	3			
	21-1-24								2	2	21	4	2			
	12-4-9									4	1	10	8	3		
	20-1-13									3	4	15	4	2	2	1
	12-4-31										5	9	4	5	2	
	12-4-31-5															
	12-4-31-7															
	12-4-57											1	10	7	4	

at the top of the table do not apply to them. They were included in this table in order to make comparison easier. They are placed in relation to the third generation families as they would be if grown in the same year, Many more third generation families were grown than are shown in the table. Additional ones are recorded in another paper (4). The present table gives only a few representative ones.

In connection with this table the following points should be noted:

(1). F_3 families are found in all possible positions between the parental extremes and coinciding with the extremes. This may be due in part to environmental influences but the resemblance of the F_4 families to their F_3 parents in regard to position makes it appear to be the result of genetic constitution. The proportion of F_3 families at any particular location in the general range of variation (a point which would be of importance for Mendelian analysis) cannot be stated because the amount of work involved permitted the raising of only a limited number of families and these were from parents scattered over the whole range of F_2 variation.

(2). There is great difference in the variability of different families. For example number 12-4-16 varies from the lower extreme of the early parent to the higher extreme of the late parent, while the range of variation of several other families covers only five days. In a Mendelian interpretation the greater variability of some families is due to the segregation of factors while the slight variability of others is due to the homozygous condition of the F_2 parent. It is to be noted that the very variable F_3 families gave rise to some very variable F_4 families and to some slightly variable ones, while the slightly variable F_3 families produced F_4 of the same kind. If only a small number of hereditary factors are involved all the intermediate F_3 families should show a wide variability.

(3). Most of the F_3 families, like the F_2 show no heaping up of individuals at any particular position.

(4). In several F_3 families the earliness of the early parent has evidently been recovered in the homozygous condition. This is confirmed by the F_4 results. Many fifth generation families raised in 1920 also were evidently quite as early as the early parent and were homozygous as well, though extended individual records could not be taken. Some families are also as late as the late parental variety. The proportion of F_2 plants which gave rise to families coinciding with the parental conditions was very small. The great majority of F_2 plants were intermediate as were the F_3 families.

(5). In one case (12-5-23) an F_3 family seems to be earlier than the early parent. One might consider this to be due to environmental influences even though a very large number of individuals of the early parent were recorded in order to determine the complete range of variation. But the F_4 families descended from it bear out the conclusion that it is really genetically earlier. If so, there must have been on the ordinary interpretation a recombination of factors by which the later parent, even though itself later, contributed a factor for earliness which the early one lacked.

The results for a cross involving a greater difference between the parents are shown in Table 5. The points to which special attention has been directed in connection with the previous table are well illustrated here and this in itself is a point to be emphasized. Certain points such as the great difference in variability in different families are more clearly evident. The complete list of F_3 families published in another paper (4) shows that all intermediate positions as well as the parental ones are occupied. A much larger percentage of the F_3 families are intermediate than in the previous cross. Nevertheless some families are evidently homozygous for the parental conditions.

Some results in the widest cross of all, which has been carried only to the third generation, are given in Table 6. Though the condition of the late parent has been recovered that of the early one has not been in the comparatively small amount of material raised. Evidently it is much more difficult to recover the parental conditions in crosses where the difference is very great. There is then no simple Mendelian segregation of one or two main factors. A factorial explanation must involve the assumption of many small factors.

The three crosses described represent three degrees of difference between the parents. Other crosses have been made involving similar degrees of difference and still others involving other degrees. In all cases the results were similar to those just described.

Discussion of Factorial Conditions.

It is evident that in all the crosses mentioned we have examples of typical blending inheritance, because most of the F_2 individuals and F_3 families are intermediate. Applying the multiple-factor explanation of blending inheritance, the great variability in the F_2 indicates Mendelian segregation. The great difference in variability among different F_3 families would then be due to the fact that some F_2 parents are homozygous while others are heterozygous for earliness factors.

In this interpretation of the results obtained there must be many factors for earliness and lateness. Even the varieties whose means are only a few days apart must differ by several factors because the great majority of F_2 individuals are intermediate—so that simple segregation of one or two pairs of characters is not occurring—and true breeding intermediate races are quickly established.

It is to be expected that many factors in the hereditary constitution will affect the rapidity of maturing. In addition to factors directly concerned with earliness, many factors whose primary effects are on entirely different characteristics may have secondary or indirect effects on earliness. Thus a factor which causes the production of a short stem may because of this fact put forward the ripening period.

While the results of each individual cross can thus be explained on the multiple-factor hypothesis there appears to be difficulty in explaining the results as a whole. As already pointed out each successive pair of parental varieties must differ by a certain minimum number of factors where there is blending inheritance. Summing up the factor differences between the individual pairs we get the number of factors by which the latest differs from the earliest. And this result can be checked by a direct cross between the latest and earliest. The greater the number of factors the less the probability of recovering the parental types in F_2. For example where the differences between the parents involve six pairs of factors the smallest number of F_2 plants which must be grown in order to secure the parent type will be 4096 (Mendel's 4^n where $N=6$); for 7 pairs of factors 16,384; for 8 pairs 65,536. Now the F_3 and F_4 results show that in all crosses except one the parental conditions were actually recovered among at most a few hundred individuals of the F_2. In the case of A x E the early parental type has not been recovered in the comparatively small number of plants raised, though the late parental condition was recovered. The results obtained on the mul-

TABLE V.
Days from planting to ripening

	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147
A.																				
D.																				
AD 3-4-14.	1	6	1	6	8	4			2											
3-4-14-2.																				
3-4-14-6, 9, 11.																				
3-4-14-5, 7.																				
2-1-8.	3		5	3	3	8		2												
2-1-8-1.																				
2-1-8 2.																				
10-3-35			7	1	5	3	1	8	3		3									
10-3-35-3.																				
10-3-35-seven families																				
3-4-27		2		2		1	5	4	7	7	11			3	3					
3-4-27-4.																				
3-4-27-1, 3.																				
3-4-27-2																				
3-4-27-7																				
3-4-27-9.																				
3-4-27-12.																				
14-1-5.			2	4	1	6	2	18	2		1			2	1					
14-1-5-3.																				
14-1-5-4.																				
14-1-5-1.																				
14-1-5-2.																				
14-1-5-6.																				
14-1-5-10																				
14-1-5-7.																				
14-1-5-8.																				
14-1-5-11																				
3-4-19.		5		9		8	2		2	2	1	1			1	3	2			
3-4-11.						2	0	9	4	5	2	1								
3-4-11 3																				
3-4-11-1 4																				
10-3-10									3		19			2	5					
14-3-21.								1	0	7	12	2	3							
14-3-21-1																				
14-3-21-3																				
14-1-12					3	2	3	16	2		11			3	3	1				
14-1-12-3.																				
14-1-12-1.																				
14-1-12-4.																				
14-1 12-5.																				
14-4-19.							2	2	1	2	8	1		4	2	2	2	1		
14-1-24										4	10	8		16	3					
14-1-31										7			3	2	18	7	1			
14-1-47.															1	15	14	4	1	
14-1-47-2.																				
14-1-47-5, 6.																				

tiple-factor hypothesis by adding up the factors which must distinguish the successive pairs, are different from the results obtained on the same hypothesis in a direct cross between earliest and latest. This question has been more thoroughly discussed in another paper (4).

Throughout the course of the experiments a close watch has been kept for the correlation of characteristics with earliness or lateness in order to find whether it is possible to combine extreme earliness with all other desirable qualities.

The great majority of the early segregates in all crosses are small and unproductive. It is not possible owing to gradations in size and productiveness to give the exact proportion. The great preponderance of unproductive plants among the early segregates is of course to be expected if only on physiological grounds. Nevertheless there appears to be no absolute linkage in this respect because some large, vigorous, productive segregates breeding true to these characteristics and at the same time as early as the early parent have been secured in crosses between very early small parents and standard varieties. But a very large number of F_2 and later generations have to be grown in order to obtain them.

No linkage has been found with any other characteristics. If many factors for earliness are distributed through all the chromosomes, one of these factors might be linked with a particular characteristic located in the same chromosome. But all the other factors for earliness obviously would not be linked with this one. And the effect of the single factor would not be missed out of so many.

Several of the facts brought out in these results have the effect of making it very difficult to secure very early hybrids with all other desirable qualities. Since most of the F_2 are intermediate a great many must be raised in order to secure any number as early as the early parent, and the greater the difference between the parents the greater the number that must be raised. Of the early ones obtained in this way most, again, will be small and unproductive. Of the few, if any, which remain after these eliminations, a large percentage must be further eliminated because of other undesirable qualities (such as seed color, baking quality, etc.) if, as is generally the case, the early parent had any such undesirable qualities. The chances, therefore, of getting a necessary combination of good qualities along with earliness are small. It is, however, apparently only a matter of raising a sufficiently large number of F_2 plants. As only one seed is obtained for each cross pollination this means an immense amount of time and labor. Of course if an intermediate condition between the two parents is all that is desired, the task is very much lightened.

Literature Cited.

1.—East and Jones—Inbreeding and Outbreeding. Lippincott Co., Philadelphia 1919.

2.—Leake, H.M.—Studies in Indian Cotton. Journ. Gen. Vol. 1 pp. 205-372. 1911.

3.—Thompson, W.P.—The Inheritance of the Length of the Flowering and Ripening Periods in Wheat. Trans. Roy. Soc. Can. Ser. III. Vol. 12. 1918.

4.—Thompson, W. P.—The Inheritance of Earliness and Lateness in Wheat. Trans. Roy. Soc. Can. Ser. III. Vol. 13. 1919.

5.—Tschermak, E. V.—Ueber die Verebung der Blutezeit bei Erbsen. Verh. Naturf. Verein., Brunn. Vol. 49.

British Columbia Dairy Farm Survey

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The report as submitted is based on a preliminary survey which it is planned to extend to other farms and districts during the coming years. The conclusions on one year's operations are consequently tentative.

During the summer of 1920, the Animal Husbandry Department of the University of British Columbia conducted a dairy farm survey in three milk producing districts of the Province. Two of the districts were in the Fraser Valley and one on Vancouver Island. The survey included 26 farms in the Chilliwack district, 13 in the Ladner area and 15 in the vicinity of Courtenay on Vancouver Island.

Why and How the Survey Was Made.

The purpose of the survey was to determine the factors that make for profit or loss on dairy farms as they are operated in British Columbia.

In order to get the necessary information a field man went to each farmer included in the survey and secured detailed records of each farmer's receipts and expenses for one year. The year's business included in the survey extended from May 1st 1919 to April 30th 1920. In addition to the business transacted during the year, an inventory of all live stock, equipment, buildings and land was taken for both the beginning and end of the year.

From the figures gathered directly from the farmers as above, and with the co-operation of feed houses and creameries that were able to give detailed accounts of the feed the farmers bought, and the milk the farmers sold, data has been secured from which several conclusions have been drawn.

Explanation of Terms Used.

Labor Income. — The Labor Income is the difference between the total receipts and total expenses on the farm. The expenses include interest on capital at 7 per cent, depreciation on buildings and machinery during the year, wages for labor including family help, but does not include wages for the operator of the farm. No record is made of farm products used in the house except in case of beef and pork. In other words the labor income is the return the farm operator receives as wages after allowing for interest on investment and depreciation on equipment. Farms which show a minus labor income may yet provide a living for the farmer. In these cases he lives on such interest on capital as the farm actually pays, or it may be wages which are allowed to members of the family, but which are not paid in cash by the operator. If, however, he must pay interest on investment and wages for work performed by his family, two alternative courses are open to him, either he must eventually leave the farm, or so arrange his operations that his labor income will be increased.

Labor Income represents the wages the farm returns to the operator for his labor and management of the farm. It is used as a means of comparing the efficiency of one farm with that of another. Variations in Labor Incomes are due in many cases to unavoidable circumstances, but largely they are due to factors that come more or less within the farmer's control.

Animal Unit. — A mature cow kept on the farm for a year is termed an animal unit. All other live stock is reduced to the animal unit basis according to the amount of feed consumed and the number of months kept. A farm having 30 animal units has sufficient live stock to consume the same amount of feed as would 30 cows in one year.

Live Stock Index. — This is a measure of the efficiency of the live stock. A farm having a live stock index of 100 would be one where the gross live stock receipts per animal unit were equal to the average for the survey. A live stock index of 90 would indicate that the gross receipts per animal unit were below average and one of 110 would indicate that gross receipts per animal unit were above average.

Crop Index. — This is the measure of efficiency in the production of crops. It is based on yields per acre. A crop index of 110 would indicate that the crop yields were above average and a crop index of 90 would indicate that the crop yields were below average for the survey.

Diversity Index. — This expresses the percentage of receipts from the sale of milk and milk products. A

diversity index of 100 would indicate a farm where all receipts came from dairy cattle. A diversity index of 50 would indicate a farm where only 50 per cent of receipts came from milk and milk products, the other 50 per cent coming from other sources.

Tillable Area. — As rough pasture land and other untillable land adds to the feeding capacity of the farm, they must be considered in the total tillable area. To reduce the whole farm to a tillable area basis, it is estimated that 3 acres of rough land and 10 acres of pastured woods produce feed equal to one acre of tillable land. Thus to the tillable area of a farm is added one-third of the rough land and one-tenth of the pastured woods. The total is known as the tillable area of the farm.

THE EFFECT OF GOOD CROPS AND GOOD LIVE STOCK ON LABOR INCOME.

Table No. 1.

Groups	Poor Live Stock	Good Live Stock
	(1)	(3)
Poor Crops	13 Farms Minus $313.43	19 Farms $333.06
	(2)	(4)
Good Crops	10 Farms $230.87	6 Farms $1,207.65

The farmers of group No. 1 grew poor crops and fed the crops to poor live stock with the result that the returns from the farms neither paid wages or interest on investment.

Group No. 2 grew good crops and fed the crops to poor live stock and made a gain over group No. 1 of over $500 per farm, thus showing the great effect of good crop yields even when fed to poor live stock.

Group No. 3 grew poor crops, but fed this to good live stock and made over $600 gain over Group No. 1. It should also be noted that Group No. 3 surpassed Group No. 2 by over $100, thus showing that on dairy farms where the great percentage of receipts come from the cows it is even more important to have good live stock than to have good crops.

The farmers of group No. 4 have grown good crops and have kept good live stock and their return is over $1,200 net. This is a gain of over $700 over Group No. 2 and $600 over Group No. 3.

The table shows that to get a fair return from the farm, good live stock and good crops are essential factors.

THE LABOR INCOME AS IT IS AFFECTED BY THE PURE BRED SIRE.

Table No. 2.

Kind of Sire and No. of Years in Use on Farm	No. of Farms	Average No. Years P.B. Sire in Use	Labor Income
Grade Sire	11		Minus $ 41.95
Pure Bred Sire 1 — 5 years	20	3.2	$216.04
Pure Bred Sire 6 — 10 years . ..	11	7.6	$495.85
Pure Bred Sire 11 years & over	6	16.5	$550.36

This table needs but little explanation. As soon as the dairyman can begin the improvement of his herd by the use of good pure bred sires his labor income begins to increase. The extent of this increase is brought out very clearly in the labor income column of the table. It is not a case then of — "Can I afford a good sire?" but "Can I afford to be without a good pure bred sire from which to raise my heifers?"

THE INFLUENCE OF THE PURE BRED SIRE ON THE AMOUNT AND COST OF BUTTER FAT.

Table No. 3.

Kind of Sire and No. Years in Use on Farm	Average No. Lbs. Butter fat per Cow	Average Cost of producing 100 lbs. Butter fat
Grade Sire	219.7	$119.11
Pure Bred Sire 1 — 5 years	221.9	$103.22
Pure Bred Sire 6 — 10 years	232.2	$ 93.43
Pure Bred Sire 11 years and over	252.6	$ 77.27

A very striking case is here presented in favor of the pure bred sire and against the grade sire. It will be noticed that the number of pounds of butter fat per cow increases with the number of years the pure bred sire has been used on the farm. The sire's influence is shown very clearly as well, in the cost of production of the butter fat. Again — "Can I as a dairyman afford to be without the use of a good pure bred sire?"

A COMPARISON OF DIFFERENT FEEDING PRACTICES WITH GOOD AND POOR LIVE STOCK.

Table No. 4.

		Medium Feeding	Good Feeding
Poor Live Stock	Cost of feed per cow	$81.88	$112.67
	Total digestible nutrients per cow	2,658	3,541
	Pounds butter fat per cow	186.4	211.8
	Labor Income	Minus $163.86	$135.80
		Medium Feeding	**High Feeding**
Good Live Stock	Cost of Feed per cow	$77.02	$124.78
	Total digestible nutrients per cow	2,426	3,974
	Pounds butter fat per cow	240.9	275.6
	Labor Income	$679.63	$509.39

This table shows that medium feeding of poor live stock resulted in a loss to the farmers. They were not even able to pay interest on investment. Good feeding of the same class of stock was more remunerative, however, there being a gain of about $300 per farm over the group of farmers who were medium feeders. This shows that by judicious use of feeds poor cows respond to a considerable extent. Good live stock, however, gives a much greater Labor Income. The medium feeders with good live stock fed over $35 worth less of feed than the good feeders with poor live stock, but the good cows responded in much heavier butter fat production. They also returned a much larger Labor Income in spite of the fact that they were fed less. The high feeders of good live stock secured a greater butter fat production per cow, but they fed too heavily for the most profitable immediate returns. This last group, however, may finally come out ahead, as they will secure good advertising through their high producing cows and no doubt will sell some breeding stock at fairly high figures. It is quite possible then that their Labor Incomes will be somewhat higher in future years.

In studying the above table it will be seen that the owners keep more live stock per acre which in turn would tend to keep the land more productive by providing more barnyard manure. The owners have less acreage per man and per horse, indicating that they cultivate the soil more intensively. This is also borne out by the owner's crop index. The renter's crop index is only 77 as compared to 100 in the case of the owners. The difference in quality of live stock is not sufficient to comment upon, both owners and renters having live stock about average for the survey.

A COMPARISON OF RENTED AND OWNED DAIRY FARMS IN B.C.

Table No. 5.

Averages	Owners	Renters
No. of Farms	21	9
Animal Units per acre	.49	.39
Crop area per man	17.3	27.8
Crop area per horse	12.4	15.3
Average No. acres	63	82
Crop Index	100	77
Live Stock Index	99	104
Animal Units per Farm	32.3	31.1
% Capital Buildings and Machinery	28	19
Operator's Capital	$27,298.16	$4,622.19
Farm Receipts	$ 5,192.94	$5,110.24
Farm Receipts per acre	$ 80.84	$ 63.41
Owners Int. on Investment at 7% and Renter's Rent	$ 1,929.23	$ 980.00
% of Int. on Farm Capital that Rent equals		4.28
Labor Income	$ 231.41	$1,238.93

The owners have a greater percentage of capital in buildings and machinery in that the renters do not own buildings. The operator's capital is also less in case of the renters as they do not have capital invested in land.

A very marked difference is shown when we compare the owner's interest on Farm Capital at 7 per cent and Renter's rent. The owner's interest has been allowed at 7 per cent and the rent the renters pay is equal to 4·28 p.c. interest on Farm Capital. This accounts for the difference here. The difference in labor income of the two just about balances the difference between the 7 per cent the owners are allowed on their capital and the 4.28 per cent the renters pay in rent. The conclusion one would draw from a study of this table would be that from the standpoint of financial returns as shown in labor income the renters have the advantage.

Rate of Interest on Farm Capital That Farms Return.

We have found that several farms in the survey return a minus labor income; other farms show a very fair return. These minus labor incomes are the result of farms not being able to pay interest on capital at 7 per cent. If the farms do not pay 7 per cent interest on capital, then what interest on investment do they return to the farmer? We have found that after allowing wages to the farm operator at the rate of $80 per month on a group of 37 farms that the average rate of interest the farms returned was 3.8 per cent. This is very close to the return the landlords get when they rent their farms, which is 4.28 per cent interest on capital. When we consider that the landlords have yet to pay depreciation on buildings out of that rent it would bring their return for capital invested to practically the same figure as the average owners get by operating their own farms.

Table No. 6 shows a comparison of farms according to size and also the effect of diversification from dairying on different sized farms. Groups 1, 3 and 5 on small, medium and large farms respectively include farmers who have diversified their farm operations, or in other words, have received a greater proportion of their farm receipts from cash crops than have groups 2, 4 and 6. Groups 2, 4 and 6 include farmers on the three sizes of farms who have specialized in dairying to a greater extent than groups 1, 3 and 5.

In comparing the labor incomes of groups 1, 3 and 5, it may be seen that the larger the farm the greater the labor income. This is due to the fact that the men on the larger farms operate at lower cost per acre. They conduct a larger business and reap the benefit in increased labor income according to the size of the business. The cash crops that have made this result possible on the large farms are mainly grain and hay. Most of these large farms are located in the Ladner area. Grain and hay sold for high prices during the year covered by this survey. Another year may not show such a marked difference in favor of cash crop farmers. The farmers in that district realize that such a practice depletes the soil of its fertility. Just to what extent cash crops of hay and grain may be grown without affecting soil fertility has not been definitely determined. Such practices may not apply to other districts included in the survey. However, other side lines, such as hogs, sheep, poultry, or possibly fruit may be incorporated as cash crops to good advantage. The cash crops adopted should depend upon the farmer's experience, the type of soil, climate and market conditions.

In comparing groups 2, 4 and 6, the groups which have received a less proportion from cash crops than groups 1, 3 and 5, it will be seen that the labor incomes do not increase as does the size of the farm. The farmers on medium sized farms who specialized in dairying received a marked increase in labor income over the same class on small farms. Those who had large farms and specialized in dairying over 60 per cent made practically the same labor income as did the same class on medium sized farms. This would indicate that it would have been a better policy in case

EFFECT OF DIVERSITY ON SMALL, MEDIUM AND LARGE FARMS.

Table No. 6.

Size	% Receipts from Dairy Cattle	Group	No. Farms	Average Acres	Average Diversity Index	Average Crop Index	Crop Area Per Man	Crop Area Per Horse	Average Labor Income	Best Labor Income
Small										
Up to	Below 80%	1	6	28	72	86	15	11	$ 228.15	$ 948.98
35 acres	80% & over	2	4	17.6	89	73	10	7	$ 87.22	$ 296.95
Medium										
36-100	Below 80%	3	13	61.7	63	92	21	14	$ 572.95	$2,408.64
acres	80% & over	4	14	68.3	88	92	18	12	$ 339.11	$1,898.17
Large										
Over 100	Below 60%	5	6	239.5	40	104	35	25	$2,129.98	$6,681.67
acres	60% & over	6	9	139	76	104	29	17	$ 340.86	$2,433.49

of group 6 to have arranged the farm business so that a greater percentage of receipts came from cash crops. The average labor incomes of groups 1 and 2 are both low. Their size seems to be such that it is difficult to keep a sufficient number of cows to give a fair income, compared with the two larger sized groups. On small farms in order to secure an income proportionate to the larger farms some cash crops which would give greater returns per acre should have been incorporated with the dairying which would have given greater returns per acre than did cows alone. To summarize then, it would appear that cash crops or side lines are instrumental in raising labor incomes on all sizes of farms.

It may be noted that the farmers of groups 1, 3 and 5 were able to employ labor more economically than did the farmers of groups 2, 4 and 6, as is indicated by the columns headed "Crop area per man", and "Crop area per horse."

The farm operations should be so planned that the greatest return is received for labor expended and capital invested. Such side lines as hogs, sheep, poultry, grain or perhaps fruit, may be incorporated where these would fit in well with the organization of dairy farms. This would assist in economizing on labor, also in using to advantage by-products of the dairy and in making greater use of products of little value in the production of milk.

The crop index column shows that the larger farms grew the best crops. This is contrary to expectations. The farmers on small acreage should produce the heaviest yielding crops. Although their crop acreage is small it cannot be overlooked and high yields would cut down feed bills quite materially and thus add directly to their labor income.

The column headed "Best labor incomes" shows what was actually done on some farms during the year this survey covered. The largest labor incomes on the small farms were not very high for that year indicating the difficulty that many faced when they specialized in dairying on small farms.

FACTORS WHICH INFLUENCE THE COST OF PRODUCING BUTTER FAT.

Table No. 7.

Groups Cost of 100 lbs. B. F.	No. of Farms	Capital per Acre	% Labor of Farm Receipts	Crop Index	% Farms with pure bred sire 5 years and over	Fat per Cow lbs.	Cost of 100 lbs. B.F.
Below $76	12	$391.85	17.15	100.7	66.6	253.3	$62.90
$76-$100	12	$382.34	25.4	91.8	50.0	224.8	$90.46
Above $100	21	$432.94	19.5	87.0	39.0	215.0	$128.53

1

In order to determine why the cost of producing butter fat varies on different farms Table No. 7 was prepared to show what had the greatest influence. The average price the farmer received for his milk was $76 per 100 pounds of butter fat. The groups are so arranged in the table that the farmers who produced butter fat at a profit are those of the first group. The second and third groups have produced butter fat at a loss. Capital per acre plays some part in varying butter fat costs. Those who produced at a cost of over $1 per pound have an average of $432 invested per acre, which is much above the first two groups who produce at considerably less cost. The "$76-$100" group have least capital per acre, but they employ labor unprofitably, which is shown in column "Per cent labor of farm receipts," thus they were not able to overtake the first group. The Crop Index column is self-explanatory. To secure greatest returns and thus lessen cost of production, good crops are necessary as shown previously in this report.

The breeding of the herd has a very marked effect in lowering costs. It may be noted that the percentage of farms having a pure bred sire on the farm for 5 years or over is much higher with the farmers producing at lowest cost. As the percentage of farms having pure bred sires on the farm 5 years and over decreases, the cost of production of butter fat increases.

The heavy producing cows are the only ones that should be maintained in the herd. A glance at the above table shows the relationship between good breeding and high production and low cost.

The Cost of Producing Butter Fat.

For the purpose of determining the cost of producing butter fat only those farms could be used where at least 50 per cent of the revenue came from milk. All sources of revenue other than milk were considered as side lines. These side lines would have the effect of raising or lowering the cost of production of butter fat depending on whether the side lines were in themselves profitable or otherwise. This explains the necessity of rejecting all farms which had less than 50 per cent of their revenue coming from milk alone.

The method of determining the cost of producing butter fat may best be shown by actual figures from one farm.

FARM No. 50—A RENTED FARM.

Size 90 acres		Pounds butter fat sold	4,383
Number of cows 14		Total farm capital	$30,379.95
		Operator's capital	$ 5,179.95
Farm Expenses.		**Revenue from Sources other than milk.**	
Labor hired	$ 965.00	Crops sold	$ 35.00
Feed bought	814.15	Eggs	30.00
Seed bought	68.50	Increase & sales of cattle, hogs & poultry	1,684.25
Repairs	17.60	Increase in feed and supplies	276.25
Taxes	20.00		
Rent	1,600.00		
Other farm expense	274.10		
Depreciation on buildings & machinery	203.45		
Interest on capital at 7%	362.59		
Labor of operator	960.00		
Total farm expenses	$5,285.49		
Revenue from side lines	2,025.50		
Cost of producing milk	$3,259.99	Total receipts from side lines	$2.025.50

4,383 lbs. butter fat cost $3.259.99
100 lbs. butter fat cost 74.38

The cost of producing butter fat on 47 farms was calculated by the methods here shown. This includes farms in the district of Chilliwack, Courtenay and Ladner. The average cost of production was found to be $92.97 per 100 pounds of butter fat or 93 cents per pound.

As the cost of production per 100 pounds of butter fat varied on different farms from $50.76 to $193.85, it can readily be seen that the average price as determined by the survey is merely approximate.

Plows and Plowing

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(Concluded from the April issue.)

PART II.

Hitch Not Right.

Now we have come to the last source of trouble and probably the cause of more plow trouble than all the rest put together. Therefore we will be justified in going into some of the factors underlying the draft of plows. They must be thoroughly understood if we are to hitch intelligently to a plow. From the questions asked and the interest shown it may be safely said that farmers are at least interested and anxious to hear the subject discussed. After this point the battle is won. When you hear of a new idea you do not pass your opinion upon it right away, but if you find that it may be of value you most likely adopt the new plan.

When hitching four horses to a wagon, would you consider it good practice to put three on one side of the tongue and one on the other? You hitch to the centre of your stoneboat. Why? For the simple reason that it pulls straight. Why do you not hitch to the centre of your plow? If you plow tandem or four abreast, with one horse on the plowing, one in the furrow and two on the unplowed ground, you do hitch to the centre; but if you put one in the furrow and three on the land, you do not. If you have a good farm and can get on a good half mile furrow let me show you why you should plow tandem.

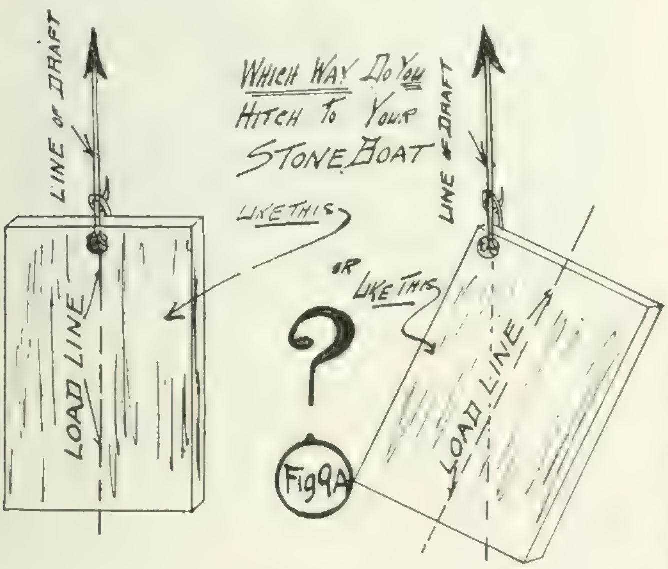


Figure 9A

Take a board and bore a hole in the centre, and when you attach a string and pull it along you will notice it pulls straight. Bore another hole in one corner and you will see that the board pulls at an angle. The centre line is the load line or centre of draft line and is fixed for the board and the stoneboat. But, you say, what has this to do with the plow? Where is the centre line in the plow?

It is about two inches inside the landside of the plow bottom (see Figures 10, 10A and 10B). It may move closer to the centre in the steeper forms of mold boards. You will see the loadline for each plow bottom marked as well as the centre of draft line for the plow, 19 inches from the furrow wall. Why is the load line not in the centre of each furrow? Because it takes 50 per cent of the total draft of the implement to cut the furrow slice, and therefore the loadline is nearer the landside. You cannot hitch four abreast (and further reference to four abreast

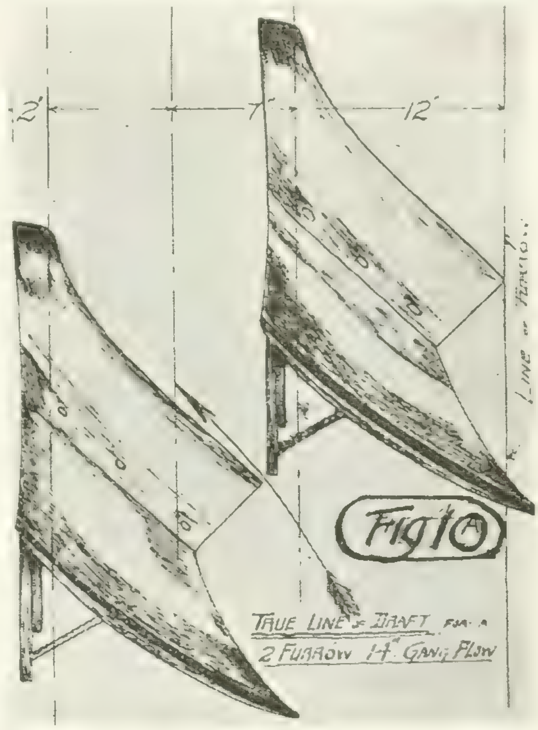


Figure 10.

means three on the land and one in the furrow) and hitch at a point 19 inches from the furrow wall. You have to hitch further to the land and the result is the plow pulls at an angle. (See Figure 10C.) To overcome this twisting effect you give your front furrow wheel "lead" away from the land. Is that not so? It takes power to hold the plow straight.

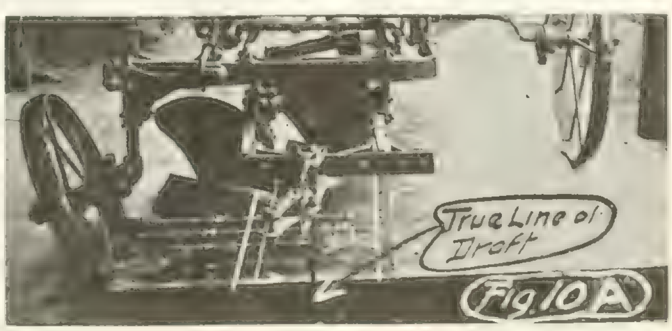


Figure 10A.

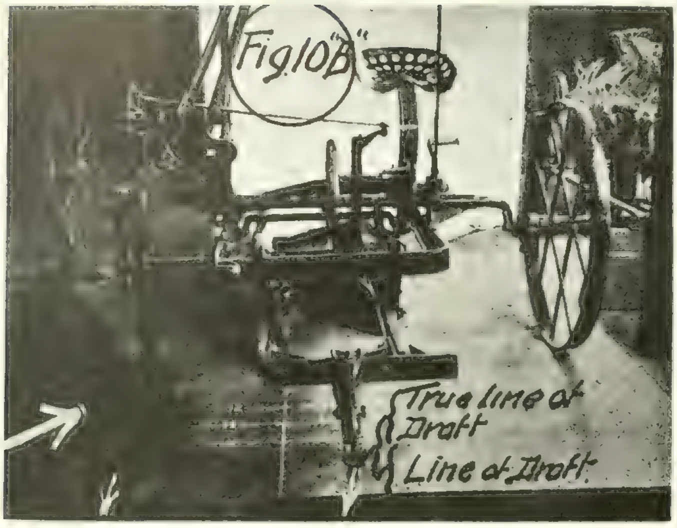


Figure 10B.

If you do not think it does try putting wheels at an angle on a wagon similar to a disc harrow and then you will agree with this line of thought. With patent eveners "to remove side-draft" go easy and make sure they do so before you buy. They will hold the plow straight, I grant you, but they do so at the expense of power. In other words, the team holds the plow straight. Under the most ideal conditions the centre of a four abreast hitch will be about 27 inches from the furrow and with the centre of the plow fixed and immovable at a point 19 inches from the furrow wall you can now see that there must be a tendency to twist the plow towards the plowed ground or what is known only too well as "side-draft."

It wears out wheel boxings and horseflesh to an alarming extent. At this point your attention is called to Figure 10D. It shows two common types of replaceable boxings. Farmers have brought wheels to us to find out how to remove the boxings. A small bolt is usually found in the hub. After it is removed the boxing is driven out with a heavy hammer. The solution is plow tandem and then the centre of the plow will be in the same straight line and everything will run well. Some say that it takes so much power, because the team is

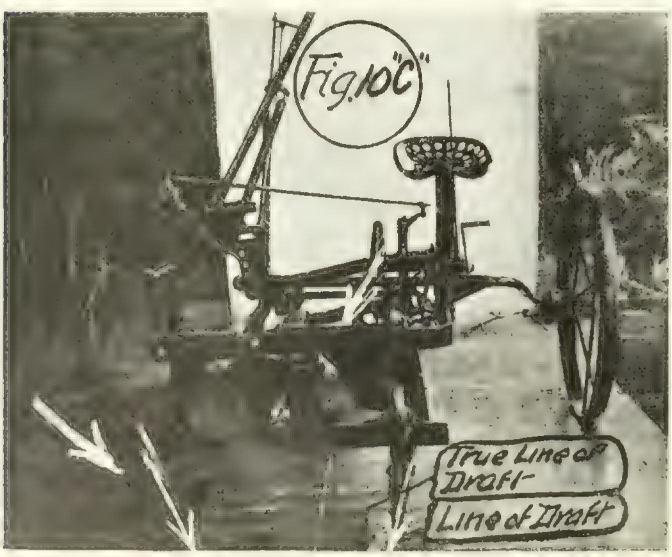


Figure 10C.

farther away from the work. The lead team is not far enough away to make any material difference, and the power that would be consumed in overcoming sidedraft is eliminated altogether. This clinches the argument for the man who wants the best way.

We have not taken up many points in connection with the subject that might have been dealt with, but perhaps we have interested some reader.

What are you going to do about it?

One good plowman in a community will do more good work towards improving the plowing in that district than a thousand articles. Get busy and arrange to have a real live plowing match next June. The Department of Agriculture or the Agricultural College ought to help you. Put the arrangements in the hands of energetic men and help them to get entries. Have some classes for the boys and young men and you will be surprised how hard it will be to drive them away from the farm. The quality of the plowing will improve each succeeding year to the benefit of all concerned.

We will now deal in more detail with the following:

1. Factors influencing the draft of plows.
2. The method of testing the draft.

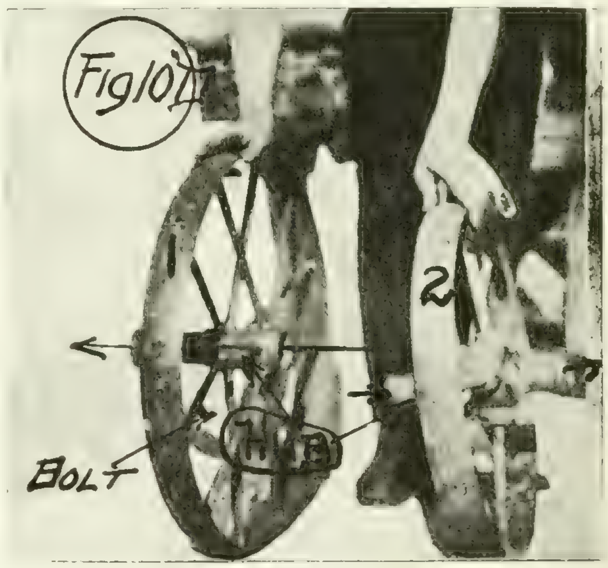


Figure 10D.

Do you know the power required to pull your plow or, for that matter, any other farm implement? In manufacturing plants, careful records are kept of the cost of operating their power machinery. This cost is watched very closely so that all the work is performed in the most economical manner thus keeping the cost of production down. Why should farmers not follow their example? If it pays a manufacturer it will pay the farmer. It will tend to convince you that the question of draft is very important, and as a means of proving this beyond all doubt I advocate that every municipality should purchase a dynamometer. (See Figure 12.) This shows a front and rear view of two types suitable for the testing of horse drawn implements. This is an instrument for testing the draft of any implement; it is simply a strong spring balance. The farmers in the district could then rent this testing device for a nominal price and thus prove to their satisfaction some important points.

You think this sounds rather far-fetched and splen-

did in theory. We have no time for that sort of thing and don't care. Listen! If it takes 1,000 pounds to pull a two-furrow gang plow cutting 28 inches and plowing 8 inches deep in summerfallow, and only 600 pounds to pull 6 sections of drag harrows covering a strip of ground 24 feet wide, does it sound reasonable to you as a practical man to make a four-horse team do the work in each case? The plowing is a 6-horse job and the harrowing a 4-horse job. Now it is some trouble to switch your whiffletrees and harness around, but it may pay you to do so occasionally. Give your teams a fair average day's work and not an overload one day and an underload the next. Of course the harrowing offers poorer footing. Let us now discuss some of the factors influencing the draft of plows.

(a) Shape of the moldboard.
(b) Condition of the plow.
(c) Sharpness of shares.
(d) Scouring qualities of plow and soil.
(e) Various adjustments.
(f) Colters and their effect on draft.
(g) Size of furrow.
(h) Line of draft.

The stubble moldboard having a sharp quick turn pulverizes the soil to a greater extent than the breaker bottom. It does more work and therefore takes more

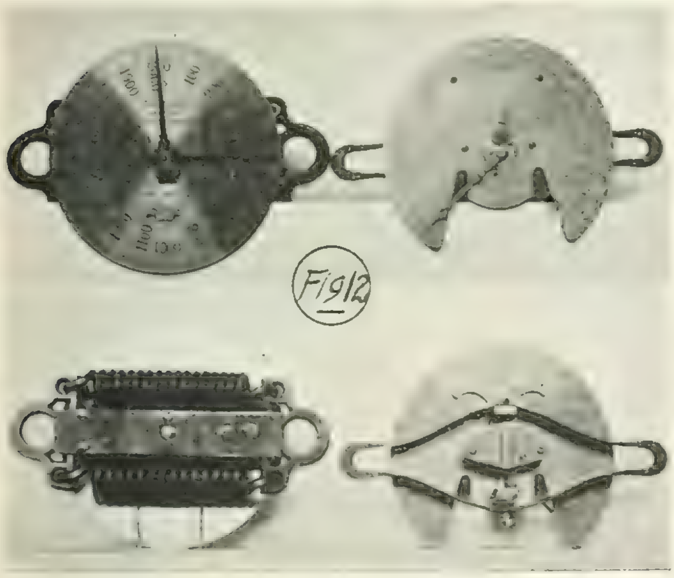


Figure 12.

power. The steeper the moldboard, the more power will it require.

Condition of the Plow.

A plow frame with loose bolts and worn wheel boxings cannot be expected to do good work. Your wife does not let her sewing machine get all loosened up. She oils it and takes care of it; that is why it lasts a life time. Manufacturers are endeavouring to eliminate this trouble by specifying spring washers on every bolt and in many cases hot rivetted frames are replacing those held together by common bolts and nuts, which will work loose.

Sharpness of Shares.

The power absorbed in severing the furrow slice demands that shares be not only sharp but properly sharpened. Sanborn reports a difference of only 6.7 per cent in favor of an old point resharpened over a dull point in the same plow, but an advantage of 36 per cent in favor of a new point over the old point resharpened. At all events farmers should not waste time on dull shares. Great care should be taken when sharpening shares to return them with the same "set". The same amount of suction both downwards and towards the land. Shares in the condition of those shown in Figure 13 are far too common.

Scouring Qualities of the Plow and Soil.

There are many different shaped moldboards for different soils. Right here let me say that unless a

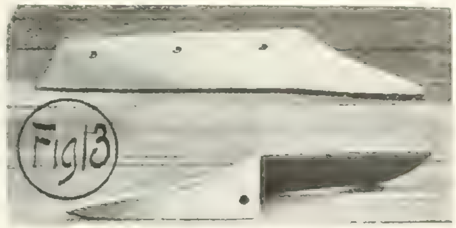


Figure 13.

moldboard plow will not scour a disc plow should not be considered. There are districts where the heavy gumbo soil demands disc plows. "Prevention is better than cure" — when you put your plows away next fall smear them well with thick oil and they will scour easier when started off the following Spring. Care must be taken to see that shares are not warped. If they are, a good joint is not made between the share and the mold board, thus causing trouble. When purchasing a plow pass the finger tips up the moldboards in the direction that the furrow slice will pass, and you readily detect rough places. At this point let me quote the conclusions arrived at from tests at the Iowa State College (Professor J. B. Davidson) on the Influence of Speed on the Draft of Plows:

1. "An increase in the field speed of a plow with a general purpose moldboard from 2 to 3 miles per hour will result in an increase of draft from 8 to 12 per cent varying with the soil. Doubling the speed will result in an increase of draft of from 16 to 25 per cent. The amount of work accomplished is increased from 50 to 100 per cent respectively.

2. The furrows are laid more smoothly and the furrow slices better pulverized at the higher speeds.

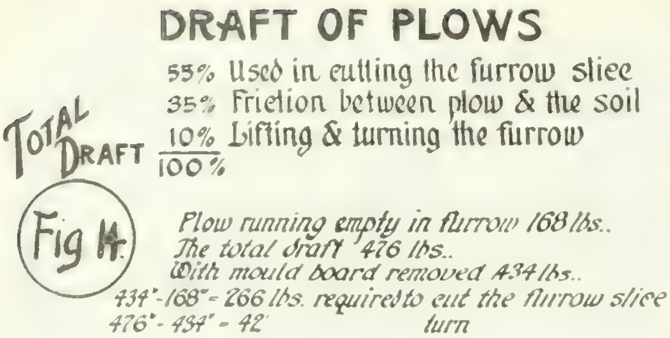
3. There are no inherent difficulties in plowing stubble ground in good condition for plowing at a speed of four miles per hour.

4. It is quite clear from observations made during the tests that plows could be operated at even higher speeds if the plows were specially designed for such speeds."

Note: (This information may be of interest to many who have not seen the results of these tests. Many opinions have been expressed. The facts were noted after very careful and exhaustive tests.

Various Adjustments.

The adjustment of the hitch will be dealt with later. The rear furrow wheel must be set outside the landside of the plow, that is towards the unplowed ground, so that the landside will be relieved of some friction. It takes power to overcome friction. Sliding friction requires more power than rolling friction. When plowing four abreast the front furrow wheel must be



given "lead" to the "land". (See Figures 10B and 10C.) When plowing tandem it is sometimes necessary to give a little "lead" away from the land, but it usually runs straight.

Colters and their Effect on Draft.

Experiments have shown that a colter reduces the draft from 11 to 25 per cent on the draft. The proper set of this attachment has also been covered.

Size of Furrow.

If you refer to Figure 14, you will see that the draft of the plow can be classified under three main heads. According to Sanborn "the plow shows the lightest draft when set to cut the widest furrow." This is probably accounted for by the remarkable results of an experiment at the Utica trials, which showed that 55 per cent of the draft was used in cutting the furrow slice, 35 per cent by the friction of the implement and only 10 per cent was required to lift and turn the furrow. The average draft of a number of plows running in the empty furrow was 168 pounds. The total draft was 476 pounds, and the draft with the moldboard removed was 434 pounds. The difference between 168 and 434 pounds was taken to be the draft required for cutting the furrow slice. He states later that 42 per cent of the draft is used by the share and the landside, and another writer put the moldboard friction at only 2 per cent. This, however, seems low. These figures will not hold for all conditions, but even an approximate idea of the division of the draft explains many frequently misunderstood facts.

Line of Draft.

When the depth of plowing is doubled the draft is increased about 75 per cent, and not twice as much, as might be expected.

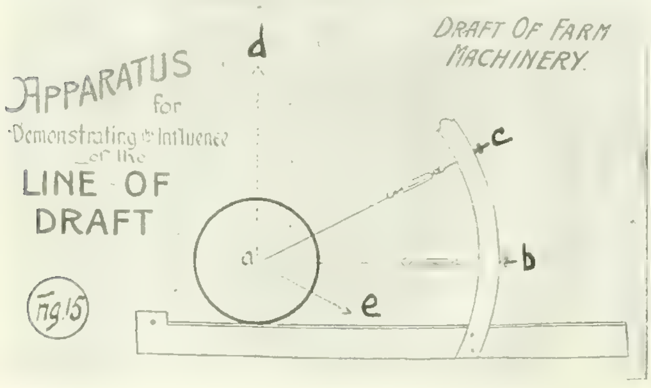


Figure 15.

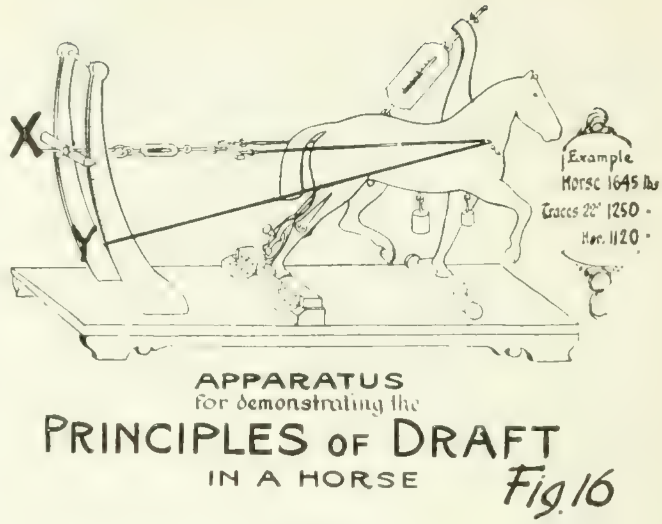


Figure 16.

We now come to the chief point which our farmer friends often wish to have discussed. Refer to Figure 15 and you will see a diagram representing a wheel and a roadbed. If a spring balance is attached as indicated we find that the easiest line of draft is a line parallel to the roadbed. This ideal condition is practically never found in any of our farm implements. It is found on the railroads where the couplings between the cars are all pulling in a line parallel to the rails. Now, if we move our line of draft to the position AC we are exerting an upward pull as well as a horizontal pull. When the position AD is reached, we are lifting the load entirely. It will be much harder to lift the load than to pull over a smooth roadbed on well-oiled bearings. On the other hand if we pull through the line AE we are exerting a downward as well as a horizontal pull which will add materially to the total draft of the implement. So much for some of the underlying principles. Figure 16 shows the effect of the line of the tugs on the load it can pull. When the tugs are horizontal we will assume that it can exert a pull of 1,120 pounds, and when the tugs are at an angle of 22 degrees it can exert a pull of 1,250 pounds. (King's Physics of Agriculture.) The reason is that the downward pull helps to give the horse a better foothold, or, in other words, more traction. If you doubt this, consider what would be the result if the point of hitch

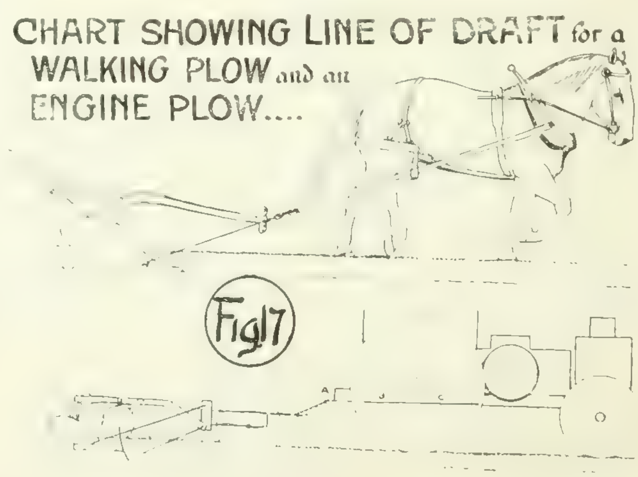


Figure 17.

X was raised up — would it not tend to raise the horse off its front legs? I think so. (See Figure 16.) The point of attachment of the tug to the hame, the point of attachment of the clevis and the centre of resistance of the plow bottom should all lie in a straight line. The same applies to engine plows. A high drawbar on a tractor and a low drawbar on a plow connected with a short stiff hitch will result in one of two difficulties:

1. In a poorly designed engine; the front wheels will be raised off the ground.

2. The front furrow wheel of plow will be raised and thus lose the tractive efficiency required to raise the power left plow.

Do not be misled by the above figures. On a steady load like a plow when the tugs are never slack, a horse will exert a steady pull of from one-tenth to one-eighth of its weight. This seems very little. How much does it take to pull your gang plow? I cannot tell you exactly; it will depend on the soil, the depth and the adjustment of the plow amongst other things. But it will be between 400 and 1,000 pounds. This seems very little, and I am sure is far below what you would have estimated. Had I asked you, you might have said 2,000 or 5,000 pounds. In the heavy soil found along the Soo Line in Southern Saskatchewan, a three furrow disc was tested and found to be taking a steady drawbar pull of 1,350 pounds. This was a very heavy load for the seven horses. This pull is measured on a scale that has a capacity of 2,000 pounds. It is called a Dynamometer. The cut showing this instrument may interest some of the readers of this article. It should be an educational feature of every plowing match held in Western Canada, because it helps to solve many difficulties and decide many discussions. Farmers are interested.

The Winnipeg Motor Contest results show that an average pull of 700 pounds was required to pull a 14-in. plow 4 in. deep in breaking. The following results from a test at Saskatoon shows how different kinds of sod varied:

Western Rye	358 pounds
Brome	405 pounds
Alfalfa	700 pounds
Mixed Hay	425 pounds

These tests were not repeated but they show that there is a considerable difference. The walking plow used was cutting a furrow 13 inches by 4 inches.

The reason why plowing tandem is desirable is that the centre of the hitch can be in the same line as the centre of the plow. This centre line in a gang plow is 19 in. from the furrow wall as we saw in the last article on this subject. If you hitch away to the left hand corner of your plow, as you must when you plow four abreast, your plow tends to take up the position as shown in Figure 3.

Refer to figure 9A and you will see what happens when you hitch to one side of your stoneboat — it pulls at an angle. That's right, and so does your plow. With a three-horse outfit the position of the hitch is decided by the distance from the furrow wall to the centre of the large doubletree, but bear in mind that the centre of the plow is still 19 in. from the land side.

Eveners Which Remove Side-Draft.

I hear someone say that there are eveners on the market that will allow you to use four horses abreast and remove sidedraft. I have never seen them yet, and no one selling such a device has ever convinced me that they do remove side-draft, because they don't. Well, the plow pulls straight. If you hitched to one side of your stoneboat and put a brace across to one corner, it would pull straight. What would pull it straight? Why, the brace, of course. I have no quarrel to pick with anyone selling such eveners, if they can. But you as a practical man can prove to yourself that they do not remove sidedraft. Take a few pieces of lath and make a model. When you pull in the direction of the arrow on the right, there is a pressure in the direction of the arrow on the left. With four abreast you give your front furrow wheel lead to the land in an endeavor to hold your plow straight, and the rear furrow wheel lead away from the land for the same reason. It takes power to hold a plow straight. Your argument about the horses being closer to their work breaks down when you think of the power wasted in holding the plow straight. Actual trials have shown that in the distance the lead team is away from the plow, the weight of the hitch is about all that is added to the draft. The weak point lies in the fact that the lead team has not as good traction. The angle of the tugs is less than in the case

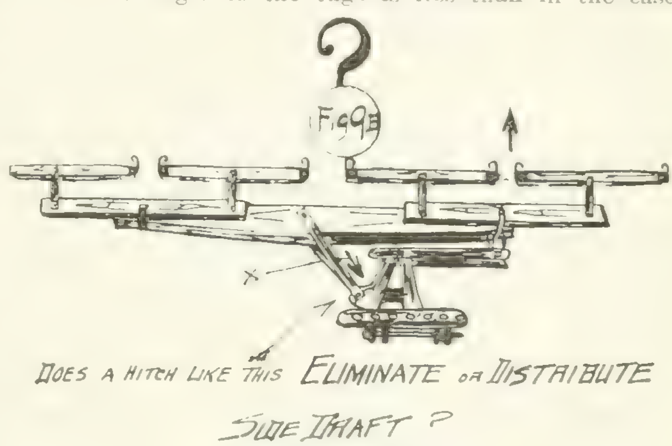


Figure 9B.

of the wheel teams. Stand at the side of a tandem outfit and you will notice the tugs of the wheel team are at right angles to the hames. What about the lead teams? The angle of the tugs is less. But do not overlook this very important point: the plow pulls straight, and the team has an easier day, especially in the hot weather. When a man tells you that a team cannot pull a bag of wheat at the end of a 100-foot rope, ask him if he ever tried it. It is a common argument. Remember that the distance a lead team is away from the plow should never deter you from plowing tandem.

If you insist on plowing with four horses abreast you will find that there is a decided twisting action tending to swing the plow towards the plow ground. To overcome this you will notice that the front furrow wheel has to give "lead" to the "land" and the rear furrow wheel "lead" away from the "land". It takes power to overcome this twisting action. (Refer to Figures 10A and 10B.) Would a wagon pull harder if it had wheels like a disc harrow? I think so, and so do you.

The following may be of interest: The pull on tugs has a tendency to lift the plow out of the ground and some other force must overcome this lifting tendency or the plow will not stay in the ground. If there is not enough suction to overcome this lifting action of the hitch, you must increase the suction.

Tests made at one of the Experiment Stations show that hitching a 9½-foot chain between the end of the plow beam and the evener made a saving of 6 per cent in the draft of the implement (a 14-in. walking plow) while a 13½-foot chain made a saving of 8 per cent in the pull of the plow. You see when you increase the length of the hitch, you decrease the lifting action, and, therefore, reduce the power by the amount necessary to overcome this lifting action. (See Figure 17.) We know this is not a practical experiment, but remember a very short hitch is not necessarily the best.

With a short beam plow the tendency to lift the plow out of the ground is greater. The suction has to be increased. Two forces, one lifting out, the other pulling it in, take power, therefore the experiment just referred to is interesting.

The draft of plows varies in different soils in approximately the order of the following:

Sandy soil, 2 to 3 pounds per square inch of cross section.

Sandy loam, 5 pounds per square inch of cross section.

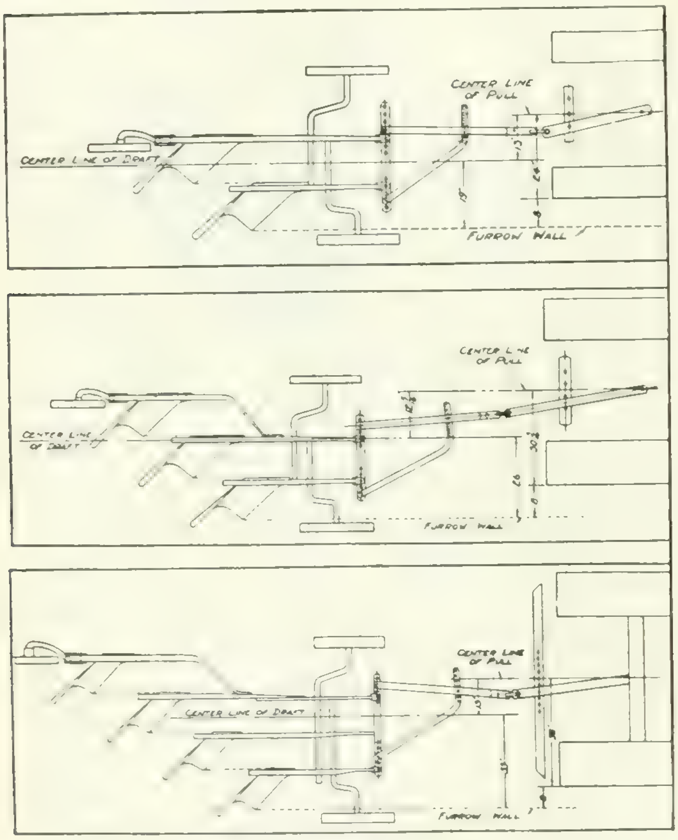


Figure 18.

Prairie sod, 15 pounds per square inch of cross-section.

Gumbo, 20 pounds per square inch of cross-section.

Example: If you have a furrow 14 in. wide and 5 in. deep, you multiply 14 x 5, equals 70 square inches and if it takes 700 pounds to pull the plow there will be 10 pounds of drawbar pull required for every square inch of cross sectional area.

So many small tractors are now in use that we feel justified in devoting a little space to the hitch problem as it affects them. The following information and the illustration are applicable in a general way to all makes. Reference to Figure 10 will recall the fact that the loadline of a two furrow 14 in. plow is approximately 19 inches from the furrow wall. Then for a three furrow plow we find the load-line to be the load-line of the centre plow, or 26 inches from the furrow wall and with a four furrow plow we find it is 33 in. over. The tractor is nearly always wider than the plow. The centre of draft-line of the tractor is midway between the drivers, and the wheel next to the furrow has to be 6 or 8 inches from the edge of the furrow. What is the result? The centre of the tractor and the centre of the plow are not in the same straight line and again we have sidedraft. Since the small tractors can only stand very little sidedraft we have to hitch very close to the centre of the tractor. This places a considerable proportion of the sidedraft on the plow. By means of a solid triangular bar hitch, this sidedraft is taken care of, but not eliminated. The walking plow, the gang plow and tractor plow must be pulled straight to the land, not at an angle, if good plowing is to be the result. They must set right. They must be operated intelligently. When on a grade, the effective drawbar of the tractor is lessened by 1 per cent of the combined weight of the tractor and load, for every one foot of rise per 100 feet, or for every 1 per cent grade. For example, let us suppose that the weight of tractor ready to work with an operator and three furrow plow is 7,600 pounds. To climb a 10 per cent grade with this outfit would require an additional amount of power equivalent to a pull at the drawbar of 760 pounds. This means practically dropping a plow. Let us do all we can to pass along any information we may have to give.

In conclusion, let me assure you that the subject of plows and plowing is one of vital interest to the farmer who is a good business man, and it is hard to know where to end a discussion such as the foregoing, and so to err on the safe side, I will draw it to a close, and hope I have left enough material with you to interest you more in this important question.

THE JUNE ISSUE.

The June issue of *Scientific Agriculture* will be necessarily delayed and may not be mailed from the point of publication until June 30th. It will contain a full report of the Winnipeg Convention.

As this issue goes to press, general plans for the Annual Convention are practically complete. Local details will be attended to by the General Secretary, who will arrive in Winnipeg on June 5th. The co-operation of President Bracken of the Manitoba Agricultural College and his staff, is assured. The Lieutenant-Governor of Manitoba, the Minister and Deputy Minister of Agriculture and the Mayor of Winnipeg have agreed to attend the Convention and to address those present. There is every indication of a successful and enthusiastic meeting.

A social programme has yet to be arranged, but this can best be planned at a later date. The close of a strenuous period is the time for entertainment and complete relaxation and this will be provided on the evening of June 17th.

The General Secretary, and the members of the Dominion Executive Committee, wish to urge the attendance of every member who can possibly be in Winnipeg on June 15, 16 and 17 next.

"Hardiness" in Plants Which Live in the Open Over Winter

By L. H. NEWMAN.
Secretary, Canadian Seed Growers' Association, Ottawa.

The question of "hardiness" in plants which are required to survive the exacting conditions of winter and early spring in the northern sections of North America is one which has interested both the scientist and the practical man for years. While much data of scientific and practical value has been recorded, this has been interpreted in different ways, although the general concensus of opinion seems to be that "hardiness" in itself is a complex character and one which is influenced very greatly by cultural methods. Investigations seem to show further that different sorts are better equipped to withstand frost than are others, in fact it seems clear that '*hardiness*' is what is called a 'sort character'. This being the case, the study of hardiness must take into consideration both the *breeding* and the *feeding* of the plant. The latter phase has been dealt with in a particularly pleasing manner by Dr. Hedlund, Biologist at the Agricultural College at Alnarp, Sweden, who has shown in detail just how the food supply acts in preparing the plant to resist frost. * While this account contains very little that is new to physiologists, the manner of its presentation and the suggestions which are offered are such as to provoke considerable thought. It is explained by Dr. Hedlund at the outset that in the case of those plants which must remain outside during the winter, the damage which they may suffer from frost is due largely to the formation of ice within the cell tissue. That it is not the *formation* of ice in itself which causes the death of the protoplasm in the cell is shown by the following simple experiment which he cites as follows:

"If a stiffly frozen cabbage is taken into a warm room where it thaws out quickly, the leaves appear lax and withered. The protoplasm in the cells has been killed. The membrane which covers it has lost its semi-permeable quality and can no longer retain the soluble substances within the cell." This results in a decreased osmotic pressure, that is the pressure exerted as a result of the tendency of fluids of different kinds and densities to become diffused through a separating membrane when placed in connection with it. If the same cabbage were allowed to stand outside after it had thawed out, it might be found to be fresh and living. From this it may be concluded that it was not dead but had stood *frozen*, death occuring only when thawing took place too suddenly. Too sudden freezing was also shown to have the same effect. Many plants may be frozen stiff without injury, if they are only allowed to freeze and thaw slowly. They cannot however, stand an unlimited degree of frost. If the temperature sinks *very* low—different for different plants—the protoplasm in the cells of course dies, even though thawing takes place slowly.

In order to show the essential cause of the death of a plant by freezing, the above writer shows exactly what takes place within a plant which has been frozen to such an extent as to cause its death. He says: "When a living plant is allowed to freeze gradually, ice is formed in the intercellular spaces. The water for the formation of this ice is taken from within the cell, passing through the cell wall and forming ice on the outside of the same. The surface or area which is covered with ice is now greatly increased. The formation of ice can often become so great that the cells become separated from each other for a considerable distance. A misroscopical examination of the young bark of trees and bushes in the spring after a severe winter shows that this, on its inside, is often split in long fissures parallel with the surfaces. A plant does not seem to be damaged however by this splitting. It is therefore necessary to investigate the changes which take place within the *protoplasm* as a result of the formation of ice. As mentioned above, when ice is formed between the cells the water out of which it is formed was taken from *within* the cell. As a result of this loss of water, the cell walls are no longer distended. The volume or space within the cell being lessened by the relaxation of the cell walls, causes the protoplasm layers to contract and at the same time to increase in thickness. The protoplasm consequently undergoes a change in its form which necessitates a *re-arrangement of what are known as the plasmatic molecules*, that is the small particles within the protoplasm. An inner tearing or cleaving takes place in the protoplasm both in freezing when the volume of the cell becomes decreased as well as in the thawing when the cell again becomes distended. *It is clearly this re-arrangement of the plasmatic molecules which causes a cleaving of its inner structure so that it dies.*

Some plants are very susceptible to such action. Others again can withstand this to a certain degree if it only takes place sufficiently slow in both directions. Frost hardiness, however, is very different with one and the same plant during different seasons and under different conditions. The leaves of autumn-sown crops can withstand a temperature of 15 per cent C. (5 per cent F. above zero) and even more for some time without being injured. The newly formed leaves which appear in May however may be damaged by a very slight frost. Trees and bushes are more susceptible to frost and alternating temperatures if they have begun to grow in the spring. It is a peculiarity for protoplasm to be more susceptible to the above mentioned re-arrangement of plasmatic molecules when the temperature is comparatively high. But if the temperature becomes low, as in the autumn, the protoplasm undergoes such a change that it is much more hardy during the winter than during the summer."

The varying ability of the protoplasm to withstand this re-arrangement of its molecules is demonstrated by the author in a simple experiment in which he takes a living part of a plant and places it in water containing a solution of cane sugar, which, because of its greater concentration, is unable to penetrate the protoplasm. The greater concentration of this liquid causes the water *within the cells*, to be drawn *out* the same as in freezing and consequently causes the protoplasm 'layers' to be drawn together and thus to become thickened. A microscopic examination of superficial cell layers which have been sumersed in sugar solutions of different

* T. Hedlund: "Om Frosthardighten hos vara kalljordsvaxter, Svensk Botanisk Tidskrift, 1912, Bd. 6, h. 3.

strengths shows different conditions for different seasons. A layer taken for examination in late autumn shows that much water may be drawn from within the cell without causing the death of the protoplasm, providing the resulting concentration in the said sugar solution increases *slowly*. It is also shown that protoplasm from which water has been drawn in the above manner, or by freezing, is much more likely to be injured during the process of assuming its original form. The more water which is withdrawn, the greater is the danger involved in the process. "One can therefore draw the conclusion," says the author, "that protoplasm is more susceptible to thawing than to freezing, and that it may live through very severe freezing but may be killed during the process of thawing."

I have not been able to find any satisfactory explanation as to why protoplasm varies in its ability to withstand the effects of the cleaving which takes place as a result of the re-arrangement in its molecules or in what manner a plant may undergo a change in its hardiness through the effect of changed conditions. It is well-known that a living organism may to a certain extent adapt itself to its particular conditions of life, and that when a change in these conditions takes place, so that it does not longer stand in full harmony with the new condition, it seeks to adapt itself to these conditions providing the change is not too great or too sudden. According to Hedlund, when a plant is effected by low temperature, and is able to withstand freezing, a change takes place in the finer organization of the protoplasm so that it can better withstand an eventual re-arrangement of its small particles or molecules. This greater hardiness, it is shown, is realized only when the temperature is as low as possible without causing the formation of ice.

By freezing, a plant or plant part does not become more hardy, but on the contrary less hardy. Alternate freezing or thawing during the winter or spring is, as is well-known, much more injurious than is a steady frost. It seems clear from these investigations that frost hardiness is first and foremost dependent upon this ability of the protoplasm to withstand the changes within its small particles to which reference has been made. Obviously then the problem of the practical grower should be to provide if possible some means or some conditions of growth which will increase the concentration of liquids within the cell, and thus lower the freezing point. "This means" says Hedlund, "consists in the storing up of solubles and solids within the cell. Pure water freezes under ordinary circumstances as soon as the temperature reaches 32 deg. F. but when this water contains some substance in solution the freezing point, as is well-known, drops. The increasing of a solution's osmotic pressure by twelve atmospheres causes the freezing point to sink 1.8 deg. F., when the liquid used consists of water. Within the living cell of the plant are always to be found soluble substances in solution, but in tolerably strong concentration.

"The cell sap consists of a solution made up of such substances as sugars, salts and acids, as a result of which the freezing point is somewhat lower than 32 deg. F. The water in the protoplasm also contains certain substances in solution, so that its freezing point becomes the same as that of the solution within the same cell. Water in a plant can therefore not be frozen before the temperature has gone below the freezing point for the cell sap and, as explained above, *the stronger the solution the more must the temperature sink before freezing shall take place*. A ripe apple which is rich in sugar requires a lower temperature before freezing takes place than does one which is immature and poor in sugar." In a number of apples which were examined by Hedlund after the warm sunny summer of 1901 he found that their freezing point was about —3 deg. C (26.6 deg. F.) The osmotic pressure of the solution within these apples consisted consequently of about thirty-six atmospheres. It is pointed out further that the soluble substances within the cells define a certain limit for freezing and consequently for the re-arrangement of the small plasmatic particles. "The ice which is formed between the cells consist of pure water. In the same measure as this is drawn out of the cells for the formation of ice the concentration of the remaining liquids becomes increased. When the cell sap has become so concentrated that its freezing point sinks to that of the surrounding temperature, the freezing is delayed and the protoplasm is protected against a further shifting of its small particles. If within the cells there are found substances stored up which are not soluble in water such as starch or oil, then is the concentration obviously increased much more quickly during freezing, which latter consequently takes place at a lower temperature than when the same cells are poor in such stored-up matter."

"Assuming that a cell contains insoluble constituents to five-sixths of its inner volume, and that this on freezing become decreased by one-twelfth, there is produced as a result a *doubling* in the concentration in the cell's sap, other things being equal. Had the constituents of the same cell consisted only of one-third of insoluble substances and the freezing point, before freezing, had been the same, then had the cell sap not reached that concentration which in the foregoing case had prevented continued freezing before the volume had been decreased by one third, that is after the volume had been decreased four times as much as in the former case. *The storing up of soluble as well as insoluble substances in the cells during the summer is consequently an active means of protecting the protoplasm against damage by freezing.*" This protection against frost damage can be very materially aided by the addition of certain chemical constituents to the stored-up material, a fact which suggests the careful *feeding* of plants even to the extent of supplying this food through the medium of commercial fertilizers. A few of the conditions which are necessary in order that trees and bushes may possess the highest possible degree of frost hardiness are, according to Hedlund, as follows: "Protoplasm shall have finished its activity in good time in the autumn and shall have assumed such a quality that it may resist the re-arrangement of its small particles. The cells shall be rich in stored-up materials, both soluble and insoluble. The shoots should also be furnished with a strong layer of bark, a condition which in comparison with the two foregoing is of subordinate importance. The physiological essentials for good winter hardiness in the case of fruit trees are essentially the same as for the abundant production of flowers. The situation in which the plant is placed shall be sunny and warm, so that an abundance of carbohydrates can be prepared. Since carbonic acid assimilation is favoured by a relatively moist atmosphere in that the stomata under such conditions are more likely to remain open, trees and bushes are able to withstand more severe frost in a coast climate.

"Soil must not become so saturated with water that the roots are prevented from taking up sufficient plant food and even water, the latter being necessary to take the place of that which passes off from the leaf by transpiration, because under these conditions carbonic acid

assimilation is hindered. If the soil during mid-summer is dry in the upper layers so that nitrification is impeded and the supply of nitrogen thereby decreased, the plant then obtains a larger supply of carbohydrates. The shoots are thus forced, as a result of a smaller supply of nitrogen to conclude their growth earlier in the summer and are therefore able to mature at a time when the days are longer and the temperature more favourable for carbonic acid assimilation whereby the cells become more abundantly provided with stored-up material. A sunny and warm summer which at the same time is dry, is therefore one which induces greater winter hardiness in trees and shrubs. The different elements of plant food in the cell have consequently a great influence on the degree to which trees and shrubs may be able to withstand frost. An abundant supply of nitrogen results in the shoots starting early and growing late in the summer. Their cells become comparatively large, thin-walled and poorly supplied with stored-up material both soluble and insoluble. Such shoots are damaged very easily by a tolerably light frost. Plants must on the other hand be furnished with a good supply of *potash* in order to be able to reach the highest degree of winter hardiness. Where potash is deficient in the soil the assimilation of carbonic acid is impeded, the supply of carbohydrates is less and the cells become poorly supplied with stored-up material, and as a result are less hardy. The lack of potash may also influence hardiness in plants by arresting the assimilation of carbonic acid causing the general development of the individual to be delayed so that the shoots do not mature until late in the summer, when less carbohydrate can be prepared for storing up in the cells. A similar effect can take place through the lack of phosphoric acid. A good supply of potash and phosphoric acid consequently is a necessary condition in order that trees and bushes may be able to reach the highest possible degree of hardiness.''

The manner in which the season may influence both the hardiness of a plant and the production of flowers and fruit in the following spring was shown in Middle Sweden in the years 1901-1902. The summer of 1901 in this region was uncommonly sunny, warm and dry, while 1902, according to reports, was quite the opposite, even to a marked degree. During the summer of 1902 it was found that a White Mulberry tree (Morus alba) growing in the Botanical Garden at Uppsala and which ordinarily is very susceptible to cold and frost, had withstood the winter almost perfectly. It produced an extraordinary abundance of flowers and berries during this summer — something which almost never before had been recorded in a latitude so far north. The summer of 1902 however, was very rainy, cold and sunless, as a result of which this plant became poorly equipped to withstand the winter and was very severly injured thereby, although this winter was not especially severe.

''The extra hardiness of the Cambium and other adjoining layers depends partly on the high osmotic pressure which exists in these layers and which is necessary as a protection against the pressure which the surrounding bark exercises, and partly because of the fact that the young cells are filled with protoplasm. As a result of the latter condition the concentration of the cell content, which is always increased by freezing, becomes especially intense.''

Hardiness in autumn-sown Wheat.

At the Plant Breeding Station at Svalöf, Sweden, the question of hardiness in autumn wheat has been very carefully studied for many years. This study has been greatly facilitated by the pedigree or separate culture system which has been practiced at that institution for twenty-five years. Since each of these cultures consists of the progeny of single plants, it is possible to obtain exact data as to the relative attitudes of the different strains or biotypes towards frost. These investigations showed, among other things, that each strain has its own peculiar degree of hardiness which is transmitted in quite the same way as are other qualities. It was also shown that the frosts of midwinter may, under certain conditions, be more dangerous than is the freezing and thawing of spring, although the latter is usually believed to be more destructive.

It has been shown at Svalöf that one of the first essentials for frost resistance in autumn wheat is a well developed plant, it having repeatedly been observed that the *roughest* and best developed plants are best able to withstand the severe conditions of winter and early spring. It has also been a matter of common observation that plants from small poorly developed seed do not stand the winter so well as a rule, as do those plants which have come from seed which is large and plump.

Where the stand of autumn wheat is excessively thick, experience has shown that there is a decrease in hardiness. This is accounted for by the fact that in the case of a thick stand a smaller number of shoots are developed from each seed and these grow long and are poorer in texture. Since thick stand is influenced by soil and seasonal conditions as well as by the variety which is used, it is advised that sorts which are likely to stool heavily be not sown too thickly.

In 1899 frost did its worst damage to the autumn wheat crops at Svalöf in the spring, while in 1901 the greatest damage was wrought in January. In these cases the drying out of the shoots above ground may have been the immediate cause of the death of the plant. It is believed in fact that the 'hardiness' of a sort depends in a large measure upon its ability, by virtue of its inner and outer structure, to withstand *drying*.

The root system of the plant, judging from observations at Svalöf, also seems to play an important part in determining the degree of damage done by frost. No relation was shown to exist however between density of head, character of chaff, absence or presence of awns and hardiness.

Acclimitization of Wheat.

The matter of acclimitization in pure lines (biotypes) of wheat, while immensely important from a practical standpoint, is of great interest to the scientist in the extent to which it directly effects the question as to whether or not hereditary changes can arise from *gradual alterations* in the character and structure of the type.

Investigations which have been conducted in Scandinavia and elsewhere seem to show that if *genuine* acclimitization exists, it may be regarded as a manifestation of the inherent power of the organism to directly adapt itself to its conditions. Gains in hardiness which have been recorded in the case of such cross-fertilizing plants as Alfalfa and Maize cannot be regarded as acclimitization in its strictest sense, since in these cases the hardier forms presumably consist of combinations of characters which have been effected by cross-fertilization and which have proven more hardy than either of the parents.

An instance showing how hardier forms may be produced as a result of crossing sorts of intermediate hard-

iness has been reported by Dr. Nilsson-Ehle of Svalôf. ** In this case a crossing was made in 1908 between *Sun* and *Extra Squarehead No.* 2 wheat. In the second generation of hybrids (1910), 192 plants were selected and all seed of each sown in separate cultures in 1911. The resulting 192 plots were sown adjoining each other, while seed from the parents was also sown for comparison. Out of the 192 plots, 42 were threshed separately, and the seed obtained from each was sown on two larger plots. The winter of 1911-12 was quite severe at Svalôf, the greatest damage being done in January during a long period when the temperature persisted around 15 degrees below zero. An examination of these plots during the end of March showed that different plots showed different degrees of resistance against frost, although the plots were quite evenly covered with snow. Some plots were badly injured, the leaves being yellow and sear, while others seemed quite undamaged. Plots Nos. 2, 5, 6, 11, 23 and 24 showed greater damage than that suffered by either parent, while plots Nos. 12, 13, 20, 33 and 38 proved hardier than either of the parents. This crossing seems to show therefore that not only may *hardier* forms arise by artificial or by natural crossing but that forms which are actually *less hardy* than either of the parents may also arise. In nature, forms arising in this way would either survive or die according to the degree of hardiness by which they were characterized.

Where cross-fertilization has not been effected, no permanent changes in the direction of acclimitization have been shown to take place in *pure strains* although these appear able to *temporarily* adapt themselves to certain conditions to a considerable extent.

To recapitulate, we may conclude from the above investigations that the question of hardiness in plants must be considered both from the standpoint of the influence of *breeding* as well as that of *feeding*. In other words strains which have shown themselves to be naturally hardy should be chosen for those districts which are likely to suffer from severe conditions and these strains should then be 'fed' and handled so as to enable them to prepare themselves to withstand the damaging effects of winter and early spring to the best possible advantage.

Why Old Established Sorts May Be Hardier.

The superior ability of the old so-called "native" autumn wheat sorts of Sweden to withstand the winter has long been recognized. In fact these sorts have constituted the basis in winter wheat breeding work at Svalôf where a high degree of hardiness must be retained in all new productions. As to why these sorts should actually be hardier has long been a matter of conjecture. Within recent years rather extensive analyses have been made of growing plants both of 'native' sorts and of more recent productions to ascertain whether or not there is any co-relation between sugar content of the plant and its ability to withstand cold. The results are not absolutely conclusive but are decidedly significant. They show clearly that those sorts carrying the highest percentage of sugar are decidedly the hardiest. The above investigations were carried on during the winter of 1917-18 by A. Akermann, Hj. Johannson and B. Platon of Sweden and are published in "Sveregis Utsades fôrenings Tidskrift 1918 pp. 216, 224. An interesting summary of these investigations by Dr. M. O. Malte, Dominion Agrostologist, Ottawa, will be found in the Agricultural Gazette for April 1919, pp. 329-331. We entirely agree with Dr. Malte in concluding that "the mere fact that cold resistance has been proven to be measurable by physiologico-chemical methods, opens up a new field of particular interest to Canada."

** "Zur Kentnis der Erblichkeitsverhâltnisse der Eiglnschaft Winterfestigkfit beim weizen." "Zeitschrift fur Pflanzenzuchtung." Paul Parey, Berlin, Bd. I, 1912, pp. 3-12.

MARKETING THE 1921 *WOOL CLIP.*

All the necessary arrangements have recently been completed for the collection, grading and selling of a large portion of Canada's 1921 wool clip under the co-operative plan. In Ontario, the wool is being collected at the Winter Fair Buildings, Guelph, under the auspices of the Ontario Sheep Breeders' Association. Shipments of any size can be made to that point, by local freight, and addressed to the O. S. B. A. where they will be graded by expert graders supplied by the Live Stock Branch, Ottawa. All of these graders are thoroughly experienced wool men, highly qualified to pass the best possible judgment on each and every fleece. After all shipments are graded, the wool is sold by the Canadian Cooperative Wool Growers, Limited, Toronto. This latter Organization is a Company organized and controlled by sheepmen resident in all parts of the Dominion and which last season made successful sales of some 5,000,000 pounds of wool, on a graded basis. Of this amount approximately 650,000 pounds came out of the Province of Ontario, and consisted of some 4,000 shipments from all sections of the Province.

This comparatively new method of taking care of the wool produced in Canada is one that is not only gaining in favor each season with the sheepmen but it is serving at the same time to place Canadian wool on an entirely different plane with the Canadian manufacturer. Gradually but surely a demand is being built up with Canadian mills for certain grades which have now been standardized in this country, and which the Canadian Co-operative is ready to stand behind as uniform and satisfactory. Approximately 2,500,000 pounds of the 5,000,000 handled last season went to the Canadian trade. This is more than in any other season and it is anticipated that a fairly ready sale will eventually be found in Canada for every pound of wool that we produce. In short every effort is being made to co-operate with the Canadian Manufacturer as well as with the Canadian producer.

As for the producer, in selling co-operatively he receives full market value for his clip less actual operating cost. Good care and proper feeding are rewarded with higher grading. Lack of care and poor preparation of the wool for market means that many shipments grade as seedy, burry, cotted, sisal, etc. Thus co-operative marketing is educative. Furthermore, producers have an interest in following their clip to its ultimate goal — the mill — and they have an investment in their own marketing agency. Those who have not tried this system of marketing in the past should give it a trial this season. They should also lend a hand in furthering Canadian sales by asking for Canadian goods made by Canadian mills from Canadian wool.

A Preliminary Note on the Occurrence of Biologic Forms of Wheat Stem Rust in Western Canada[1]

By MARGARET NEWTON.[2]
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Until 1916 only one biologic form of stem rust was known to occur on wheat. During that year a form of stem rust was collected by Stakman and Piemeisel in the Palouse district of Washington and Idaho to which certain varieties of wheat were almost immune, although the same varieties of wheat in different localities could only be explained by assuming that at least two biologic forms of the rust fungus must be present, and that each form could affect only certain wheats.

An intensive study of the infection capabilities of *Puccinia graminis* on wheat, including the isolation of as many biologic forms as possible, and a study of their geographical distribution in the United States, was immediately begun by Stakman and Levine. The work has continued and expanded until at the present time practically all states have been surveyed, and numerous strains have been isolated.

The discovery of the occurrence of more than one biologic form of stem rust was not only of scientific interest but had a direct bearing on the breeding of grain for rust resistance. It showed why "few varieties seem to be universally rust resistant" (Freeman and Johnson) and explained the diverse opinions of workers in different localities as to the relative rust resistance of certain wheat varieties.

With these numerous forms of stem rust on wheat present in the United States, the question naturally arose, Do biologic forms of stem rust occur in Canada? Until the present investigation was undertaken, no specific work had been done along these lines, although observations made by Dr. W. P. Thompson of Saskatchewan University, in his breeding experiments, had suggested very strongly that strains did exist. The present work, therefore, was undertaken with the object of discovering and isolating any biologic forms of wheat stem rust which might occur in the great grain-growing areas of western Canada.

The work has been carried on for two years, and rust from forty-three different regions of Manitoba, Saskatchewan and Alberta has been tested. Great differences have been observed in the susceptibility of wheat varieties to rust from various localities. Marquis, a wheat quite susceptible to practically all forms of rust in western Canada, is highly resistant to a form at Indian Head. Two distinct biologic forms were found at Saskatoon; one infected Emmer very heavily, while the other scarcely infected it at all. In the same way Kanred showed heavy, normal infection at Brandon, Yorkton and Edmonton, and complete immunity at Winnipeg and Vermilion. Some of the forms were very virulent on many varieties while others were weak and attacked only a few varieties succesfully.

Eleven strains have so far been isolated in Canada. It is interesting to note that they include no absolutely new form, as all these strains have previously been described in the United States by Stakman. In some districts, such as Winnipeg and Indian Head, two strains were present. These differed from each other only in their action on two varieties, but repeated inoculations gave these definite and consistent differences.

A rather virulent strain was found to be quite widely distributed. It was found in seventeen different localities of Manitoba, Saskatchewan and Alberta. Should it be discovered that this strain of rust is the prevailing one in most of the wheat growing areas of Canada, the problem of breeding for rust resistance would be considerably simplified.

As Stakman has pointed out "methods for breeding for rust resistance must be changed fundamentally. The breeder must know and work with those forms of rust which occur in the region for which his new variety is intended; and even then breeding must be very largely a regional or even a local problem."

The existence of separate and distinct strains of rust, affecting certain varieties of wheat but non-virulent for others, complicates the rust problem seriously. It seems probable that the most effective method of controlling the disease is by breeding resistant varieties, but before this can be done effectively, much more must be known of the number, characteristics and geographical distribution of biologic forms in Canada.

[1] Published with the permission of the Advisory Council for Scientific and Industrial Research under whose auspices this investigation was conducted.

[2] Acknowledgement is made of the kind help and direction received from Dr. E. C. Stakman and Mr. M. N. Levine, Cereal Investigations, Bureau of Plant Industry, at the University of Minnesota, and Professor W. P. Fraser, Dominion Laboratory of Plant Pathology, at the University of Saskatchewan.

RESULTS OF DOMINION ELECTION.

On May 2nd, the election ballots sent in to the General Secretary were opened in Ottawa by Mr. Ronald Hooper, Honorary Secretary of the Proportional Representation Society. They were counted and assigned to the various candidates, in the presence of the General Secretary and the Honorary Secretary of the C.S.T.A. There were 372 ballots received. The results were as follows:

President, L. S. Klinck, University of B. C., Vancouver; First Vice-President, H. Barton, Macdonald College, P.Q.; Second Vice-President, John Bracken, Agricultural College, Winnipeg, Man.; Honorary Secretary, L. H. Newman, Ottawa, Ont.

It will be noted from these results that, with the exception of the position of Second Vice-President, the officers appointed last year have been re-elected.

A few ballots were received after April 30th, and were not, in consequence, available at the time the election took place. Seventy-one per cent of the members registered a vote.

High School Agricultural Education

By J. W. GIBSON.,
Director of Elementary Agricultural Education for British Columbia.

Agriculture as a school subject has not met with uninterrupted success in Canada. From the standpoint of its relationship to the production of wealth and of national prosperity it has maintained its position and has had universal recognition. The vocational, rather than the educational, aspect of agriculture has mainly been appreciated. Agriculture as a cultural or liberalizing study for both boys and girls in high school is gradually winning its way as other sciences have done in the past, but it must needs walk circumspectly. In the past it has occasionally suffered from the excessive zeal without knowledge of its friends and advocates and is still in that position where it may, perchance, suffer "from the ignorance of educated people."

Some of the most prominent educators of the past, have urged the claims of agriculture as a school subject, and have advocated its adoption in public and high schools. Not the least of these is the founder of our Canadian School system—Dr. Egerton Ryerson—who held such strong convictions in the matter that he included in his list of school books one on agriculture,

J. W. Gibson.

published in 1845. In the preface of this notable book the following suggestive paragraph occurs:

"The compiler has seen the youth of this country—seven-eighths of whom, become, in the course of time, engaged in the noblest of mere earthly employments, the cultivation of the soil—pass through our schools without receiving the slightest instruction in that profession to which they hope to devote the remainder of their days. Not one of the books in which they learn to spell or to read tells them of things which they can turn to profit in their future avocation; not one of them tells them of the improved modes of agriculture adopted by experienced farmers or of the changes which the applicaion of science to the arts has effected since the time their parents first set out in life."

Dr. Ryerson also planned to include agriculture as one of the subjects in which teachers could be prepared whilst attending the normal schools. At the laying of the corner stone of the Toronto Normal School in 1851 he stated part of his plan in the following sentences:

"The land on which these buildings are in course of erection is an entire square consisting of nearly eight acres, two of which are to be devoted to a botanical garden, three to agricultural experiments, and the remainder to the buildings of the institution. It is thus intended that the valuable course of lectures given in the Normal School in vegetable physiology and agricultural chemistry shall be practically illustrated on the adjoining grounds in the culture of which the students will take part during a portion of their hours of recreation." How miserably have the provinces of Canada failed to even approximate the plans of this broadminded leader after more than half a century of boasted educational progress!

Suitability of Work to Age and Interests of Pupils.

Modern pedagogy attaches great importance to the question of child interest. It appreciates the fact that each age has its own normal stage of development and seeks to meet these conditions in the work assigned, as well as in the methods used. No subject could be found that is more adaptable to the evolving interest of children than is the subject of agriculture. It begins in early school life and continues long years after school and college days are over. One's education in agriculture need never be "finished" and the subject can never be exhausted." The nature studies of the public school provide the best and almost the essential introduction to agriculture in the high school. "Nature study," says Mrs. Comstock, "is the alphabet of agriculture and no word in that great vocation may be spelled without it." It is becoming more and more evident that successful instruction in agriculture in the high school is conditioned by preliminary training in the public school, and to this extent agriculture does not differ from other regular school studies. What we stand in need of today is greater attention on the part of teachers to the principles of education and their application in the teaching of agriculture, and for this reason only professionally trained teachers should undertake to teach agriculture either in public or high schools. The time has arrived, and more than arrived, when our Canadian Universities through the combined efforts of their faculties of agriculture and education should provide professional training in pedagogy for agricultural college graduates—but that is a separate question.

The Course of Study.

Just what to teach in the limited time allotted to agriculture in the High School is a question of considerable importance, and one which presents some difficulty. Most of those who have been held responsible for the framing of courses of study in agriculture seem to have shown a tendency to include too many topics. The selection of topics in such a comprehensive sub-

ject as agriculture, suitable to all the students in all the varying districts of a large province, to the exclusion of other topics equally valuable and equally suitable to those districts, is no easy task. The difficulty arises out of an attempt to harmonize two principles which very frequently conflict when put into actual practice. First there is the principle of "local antonomy" where local interests and the availability of materials and occasions for teaching would seem to demand first consideration for a very few branches of the subject. This is best illustrated in the case of districts where the intensive cultivation of fruit is the chief occupation of the people. The oft quoted principle of "teaching in terms of environment" would almost seem to demand such procedure and from a purely educational standpoint such a limitation of the range of subject matter could be justified. But there is another principle to be considered. Diversified farming is in the ascendency and successful farming may, and probably will, come to depend upon the best methods of correlated work. Each district will, so to speak, have its majors and its minors in agriculture. The fruitgrower may find it advantageous from the standpoint of permanency and of labor supply to have poultry or other live stock, and the dairyman may find it advantageous to have a few special side lines such as vegetables or fruit cash crops. One topic there is, however, that would appear to be fundamental and universal and that is the study of the soil itself.

Agricultural principles, or in other words, scientific principles alone are universal. Agicultural practice may vary in different districts, but the fundamentals of the science are without bounds or limit. It is for this reason that in British Columbia, a province that might be properly styled a province given to specialization in agriculture, that we have decided to adopt an extensive rather than an intensive course in High School Agriculture. We do not aim at developing through the medium of a high school course a number of skilled fruit growers or poultry raisers, but we do want every boy and every girl who completes the high school course to have a fair understanding and appreciation of the scientific basis of agriculture and to know how to apply these principles in a practical way. Without going into a detailed statement of the two year course it will suffice to state that the course embodies soil study, vegetable and flower gardening, fruit growing, field crops, poultry and live stock, dairying, agricultural botany, bee keeping and entomology.

Methods Followed.

Realizing that the chief cause for past failures in the teaching of agriculture in public and high schools has been improper methods adopted in teaching, we have aimed at presenting the subject in the most approved manner consistent with average local conditions and reasonable expenditures. The "direct" method of teaching has been followed in place of the old expository or "book" method. As a matter of fact no text book is used by either teacher or students although each school is provided with a number of up-to-date reference books as well as numerous bulletins bearing on the various branches of the subject. A single room is set apart for the work, equipped as a laboratory-class-room having long tables instead of regulation desks and a stationary ledge two feet wide fitted against three of the walls and equipped with taps and sinks in the usual way. In small high schools this room is used for teaching all of the science work. Where possible a garden house and storeroom is provided where such work as potting of plants, selecting of grains and vegetables, and the preparation of material for planting is carried on. In one instance a greenhouse has been provided; in all other cases hot-beds and cold-frames are used. An important addition to the teaching equipment is the garden and experiment grounds which comprise from one-half to one acre. Most of the work involved in conducting experiments in these grounds is performed by the students themselves, although at certain times hired help is required as well. The "experimental" method is used throughout but not overdone. Occasionally the instructor's demonstration comes in with class discussion. Class instruction in laboratory and garden is supplemented by individual home projects of a more sustained character. Some of these projects run through the entire year, and are accredited in making up the standing of the pupil.

Main Objects to be Achieved.

The enumeration of educational values arising out of the teaching of any subject can easily be overdone and the position of agriculture as a high school subject will not be improved by the making of extravagant claims on its behalf. It will be possible to speak with greater assurance in the course of a few years. It is hoped that out of this study will grow a better understanding of the fundamental principles underlying the science and practice of agriculture on the part of our young people, and that such training will prove of real value to those entering the university and particularly to those proceeding to more advanced studies in agriculture. It is hoped that the students themselves will come to have a new outlook towards and a participating interest in rural life, that growing out of more exact knowledge of the laws and processes of nature will come added appreciation of the beauties as well as the utilities of an agricultural environment, and that presently we shall have a goodly number of young people who will believe in the country and will demonstrate their ability to improve and develop it.

For young people who are to become teachers in our rural schools this course is likely to prove a special value, and this is one of the reasons why girls as well as boys are being encouraged to take it. Combined as it always is with botany, chemistry or physics, it affords ample opportunity for the application of principles taught and for the most effective correlation of these science subjects. Under our present regulations agriculture may be preceded by a year in general science which comes in the first year in high school, and is followed by agriculture in the second and third years. This arrangement seems to be productive of the best results.

For some boys who manage to spend two or three years in high school, but who are unable to go further this agricultural course will have a decided vocational value. They will have come into possession of much valuable information and will have acquired sufficient knowledge of scientific principles and of approved methods of work to enable them to carry on more intelligently and with greater chances for success should they decide to go in for farming, and this in spite of the fact that the course as given in British Columbia makes no special claim in the matter of its vocational value. It does claim to be rationally and soundly educational.

Federal and Provincial Agricultural Policies*

President L .S. Klinck, University of B.C.,
Vancouver, B.C.

As one who has for some years been in close personal and official touch with those who are administering the Federal and Provincial Departments of Agriculture, I feel that it would not be just or fair to criticise adversely these branches of the Government service without at the same time pointing out some of the dedefects in the College of Agriculture—defects for which, as a member of the staff in an Agricultural College, I assume my full share of responsibility.

A fair and impartial treatment of the subject calls for more skill than I am capable of, and for more courage than I could at first muster. And yet criticism, even though adverse, need not necessarily be a cold business. If my treatment is destructive your opportunity will come in the discussion; if it is constructive, or even suggestive, let us face the issues squarely.

Because it is basic, the relationship between these three divisions of agricultural work is one of the most important questions to be considered by this Society. In my treatment of the subject I shall aim simply to sketch the main outlines, without any suggestion of finality, and shall purposely avoid being unnecessarily specific in matters of minor detail since you all know to what extent the principles enunciated will be applicable in your respective fields of endeavor.

With the salient features in the origin, history and growth of these three branches of agricultural service we are all familiar. In the initial stages in the development of each, they occupied separate and distinct fields. Gradually, however, as each extended the scope of its activities, the old lines of demarcation became less and less distinct until at present in such sub-divisions of the field as "extension," for example, a dividing line no longer exists; and one does not require unusual powers of discernment to see that there is a possibility of a like situation arising in other lines of agricultural work.

The reasons for this are obvious. Organizations, governmental or otherwise, naturally, and in large measure rightly, bend their energies in the direction from which come the public demand and the public response. If the demand is persistent enough the temptation becomes very strong for the Agricultural College man to neglect teaching and research and devote all his energies to extension. Hence we see in some provinces similar work being conducted by two or even three separate agencies, while basic work which should be done by at least one of these is almost or wholly neglected. A careful study of the relations of the Dominion Department of Agriculture with Provincial Agencies—governmental and educational—reveals many splendid examples of co-operation, but also, unfortunately, equally striking instances of lack of co-operation and co-ordination which in some cases are a near approach to chaos.

In Canada there is no industry which the Government can foster and develop with greater propriety than that of agriculture. With few exceptions our governments have recognized this fact and have voted large appropriations without always enquiring as fully as they might as to the efficiency of the organizations designed to give effect to their intentions. One of the results of this policy is that today there is a danger of re-action: in fact in some quarters it has already set in. The number of organizations functioning in agriculture and in agricultural education is considered by many to be too large and as a result the people are coming to demand an explanation.

To point out defects in a system is, however, comparatively easy; to diagnose the case is much more difficult. Skill, constructive ability and a high order of public spirit on the part of all co-operating are necessary to evolve and to put into force an effective remedy.

Reorganization of Agriculture in Canada has not been effected, or even seriously attempted, primarily because it is admittedly so difficult. And perhaps this is an opportune time to remind ourselves that respon-

President L. S. Klinck.

sibility will temper the most radical, even when given a direct mandate to effect a needed reform.

That the necessary machinery has not yet been perfected for the efficient and economical carrying out of the agricultural affairs of this country is evident. To illustrate this point I cannot do better than refer to the conditions which obtained in the Province of British Columbia in the spring of 1914. Happily that condition no longer prevails and today in few, if in any of the other provinces is there a better understanding or closer co-operation among the Departments than is to be found in the most westerly province of the Dominion.

Briefly stated, the situation in respect to agricultural organization in British Columbia in 1914 was as follows: "Colony Farm," which is a provincial government institution with a well-deserved reputation because of the excellence of many of its classes of pure bred stock, came under the Provincial Secretary. The illustration dry land farms, on which certain experiments were conducted with field crops, and in systems of dry land farming, were presided over by the Minister of Lands. Experiments on the illustration and demonstration farms outside the dry belt were planned

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*An address delivered at the Organizing Convention of the Canadian Society of Technical Agriculturists at Ottawa in June, 1920, and published in December last in the report of that Convention. The address is reprinted here because the recommendations of President Klinck are to be presented at the coming Convention of the C.S.T.A. in Winnipeg, as a basis for discussion.—Editor.

and executed by representatives of the Department of Agriculture; and when the College of Agriculture was being organized there seemed to be but one place to put it, namely, under the Minister of Education, who was also Provincial Secretary. Is it any wonder, therefore, that with three established lines of agricultural work under as many Ministers, and a fourth one projected, the people of the Province should begin asking very pertinent questions? As a result of the agitation which followed, a series of conferences was held which resulted in the drawing up of an agreement which, while it did not dispose of all the anomalies, nevertheless proved of great value in eliminating many of the more objectionable features in the old arrangement, and in constituting an admirable working basis for future lines of co-operative action.

So satisfactory has this understanding been that Professor Boving was encouraged to advocate a more comprehensive plan, designed to include all agronomic workers in the province. I am tempted to enlarge upon this very promising and significant movement, but being not unmindful of the fact that Professor Boving is the originator of the idea, and that he outlined the plan for his colleagues several years ago, I shall invite him, when opportunity for discussion is given, to state the principles upon which the organization is based and the results which have thus far been obtained.

While the illustration given to show the lack of co-operation and co-ordination which existed in British Columbia six years ago is perhaps the most striking one with which I am familiar, many of you will, I am sure, from your own observations and experience, be able to cite other examples which call for equally united and thorough-going action.

Unfortunately then, lack of co-operation still exists between (1) the Dominion and Provincial Departments of Agriculture, (2) the Provincial Departments having the same or similar problems, (3) the Dominion and Provincial Departments and the Agricultural Colleges, and, what is still more pronounced and regrettable, (4) between agricultural teachers and investigators in the different colleges.

When in addition to these main divisions we consider other organizations which are performing special service in the interests of Canadian agriculture, such, for example, as (1) the Commission of Conservation, (2) the Canadian Seed Growers' Association, (3) the Honorary Advisory Council for Scientific and Industrial Research, and others which I might name, is it surprising that the general public is coming to ask what it all means, and that many public men are becoming extremely skeptical as to the wisdom of extending a service which, to say the least, appears to be so poorly co-ordinated?

Nor is this all. Lack of co-operation, and co-ordination, not infrequently exists between departments and branches in the same division of the service, and between departments in the same institution of learning. Regretable as this is, the fact remains, and in moments of depression we sometimes fear that perhaps it will continue to persist until human nature changes for the better.

The underlying reasons for this state of affairs are not far to seek. A college education, or the possession of more than ordinary intelligence, does not, unfortunately, insure easy and harmonious co-operation. Professional jealousies, particularly among specialists, are not unknown; inter-departmental and inter-institutional rivalries not infrequently constitute a heavy handicap to the cause of progress. But perhaps the most potent reason is that the scope of the activities of the different agencies, and of the workers engaged therein is not clearly and definitely defined.

These conditions all militate against prompt and effective co-operation, as does also the almost prodigious distances which divide us—conditions which I fear will become accentuated when the West shall call for a relatively smaller number of men from Central Canada, and so will have fewer interpreters of the spirit and methods which actuate those at the seat of government.

These are a few of the very real difficulties which will confront any administrator who is courageous enough to undertake a thorough-going reorganization of a department, be it governmental or academic.

That there is need for a Dominion Department of Agriculture, for Provincial Departments of Agriculture and for Agricultural Colleges, is unquestioned. Presumably each organization has its distinctive functions to perform. There are, however, certain lines of work which are regarded by some as properly coming under two or more of the main organizations just referred to. About these the controversy centres; and it is to these that attention must be directed until the necessary adjustments have been made.

Before attempting to state my views as to the functions of each of the three great divisions of agricultural work in Canada, permit me to say that in my opinion some minor activities cannot be definitely classified and that their satisfactory adjustment can be brought about only as the result of conference and of public spirit on the part of the negotiating organizations. Even then there will be still some unavoidable duplication which, however, within limits, is not without justification from the standpoint of the investigator as well as from that of the teacher. But let duplication be reduced to a minimum and where unavoidable let us see that our energies are directed to co-ordination in plan, and the publication of results.

The following classification of functions is suggested as a tentative working basis for what I hope will prove an exhaustive study of a pressing need in Canadian Agriculture:

Functions of the Dominion Department of Agriculture.

1. National problems of administration.
2. Control measures affecting distribution and marketing.
3. All researches of national or international importance, including those undertaken to solve problems affecting interprovincial and export trade.
4. Some measures of financial assistance to the provinces to be given under strict regulations and to be conditional upon equally generous grants from the Provincial treasuries.

Functions of the Provincial Departments of Agriculture

1. Provincial questions of administration and control.
2. All illustration and emonstration work.
3. Assume responsibility for extension work where adequately staffed; where not so staffed extension work might properly be undertaken temporarily by the College of Agriculture.
4. Except where the Colleges of Agriculture come under the jurisdiction of the Minister of Education, the Department of Agriculture, through the staff of the Agricultural College, should determine the educational policy of the Province as it relates to agriculture.

Functions of the College of Agriculture.

1. Teaching: The training of teachers, researchers, farmers, members of administrative and technical staffs of Government, journalists, etc.

2. Research: (a) In pure science. (b) In applied science in relation to problems not primarily interprovincial or national.

3. Extension: The amount and character of the investigational or teaching work undertaken to be determined by agreement with the Provincial Department of Agriculture or the Department of Education.

Although, as we have noted, many splendid examples of co-operative effort are to be found in our present systems of agricultural administration and education, the fact remains that closer co-operation and better co-ordination of the agencies working for the development of agriculture in Canada is not only desirable but absolutely necessary. Some way must be found to bring our different, but naturally related organizations into closer and more effective contact. "Unity of purpose, plan and action must be secured." Unnecessary duplication must be eliminated. Agricultural research methods must be standardized so that the results obtained by one investigator may be compared with those obtained by another. Opportunities must be afforded workers in the same or related fields for contact, which cannot but prove stimulating and enlightening.

To this end a memorandum setting forth in detail the policy and work of each organization in each province should be prepared and made available for all interested.

The prospect for these needed reforms originating within the organizations directly concerned is, I fear, not such as to give large warrant for success. The suggestion that a small body of individuals, with an intimate personal knowledge of the requirements of Canadian agriculture, but preferably not officially connected with any of the three branches mentioned, make an exhaustive study of the whole question of the division of fields of work and of Government assistance thereto in all its phases is one upon which I cannot now improve. The adoption of this suggestion would, in my opinion, lay the foundation for a comprehensive agricultural policy which would meet most effectively present day requirements.

How Plant Breeding Will Popularize The Barley Crop

By G. H. CUTLER,
Professor of Field Husbandry, University of Alberta.

Notwithstanding the fact that barley antedates all our common cereal grains in point of antiquity, distribution and general utility by man, its relative position today as a world food product is exceedingly minor. Even corn, rye, rice and potatoes take precedence over it. In Canada, barley stands third in point of view of production. In comparison with oats, its greatest feed rival, total production is in the proportion of about six to one. Throughout the Middle West in Canada, its handicap in yield for the years 1915-18 inclusive, in relation to oats, is quite as great as in Canada as a whole.

When one considers barley from the purely agronomic and economic standpoints, it seems reasonable to predict that it should assume more and more a position of greater relative importance in Western Canada, and that the wide difference in production that at present stands between it and oats should be materially narrowed. In its behalf the following may be cited as merits worthy of consideration:

Earliness—Barley ripens in 75 to 100 days, oats in 90 to 125 days. This characteristic commends the use of barley to the northern sections in our prairie provinces where the season is short and early fall frosts are feared.

A Cleaning Crop.—Owing again to its earliness, barley can be used as a cleaning crop to seed land that is infested with wild oats—cutting both wild oats and barley as a green feed.

Productiveness—Averaging the yield per acre over the whole of Western Canada for the years 1915-18 inclusive the yield of barley was only 15.23 lbs. per acre less than oats. Oats, 1156.45 lbs. per acre; barley 1141.22 lbs. per acre. (1)*

Value as a Feeder's Grain—On the basis of the average yield just quoted for Western Canada and total digestible nutrients, barley yields approximately 92·6 lbs. more actual feed per acre than oats. Yield of barley, 906.8 lbs.; yield of oats, 814.2 lbs. This combined with the fact that barley far exceeds oats as a finishing grain for hogs and cattle must be viewed with much favor.

It would seem, therefore, that as a matter of farm economy and management, the barley acreage especially in all northern districts in Western Canada might be greatly extended even at the expense of oats.

That barley is not more widely grown is probably due to a number of causes, the most potent of which may be cited as (a) the tendency of barley to lodge on rich soils owing to weak straw, (b) the tendency of the heads to break off, (c) the readiness with which the seeds shatter and (d) the presence of the beards on the most productive grain varieties. In this paper the last mentioned only will be discussed.

A careful examination into cause number 4 reveals the following interesting facts:

The beard makes the harvesting and threshing of the crop very disagreeable,—growers frequently having difficulty in getting men to stock and thresh the crop.

The straw often causes sore mouths in animals that consume it. The pieces of awns pierce the membranes of the mouth and are held there by the numerous curved barbs. When sheep are fed on barley the awns work into the wool.

If we carefully examine the beard of the common barleys under a microscope we find very minute, often hooked, teeth distributed along its several edges or nerves. These teeth or barbs are the source of annoyance in the barley beard. If these were not present the beard in itself would be quite harmless and unobjectionable.

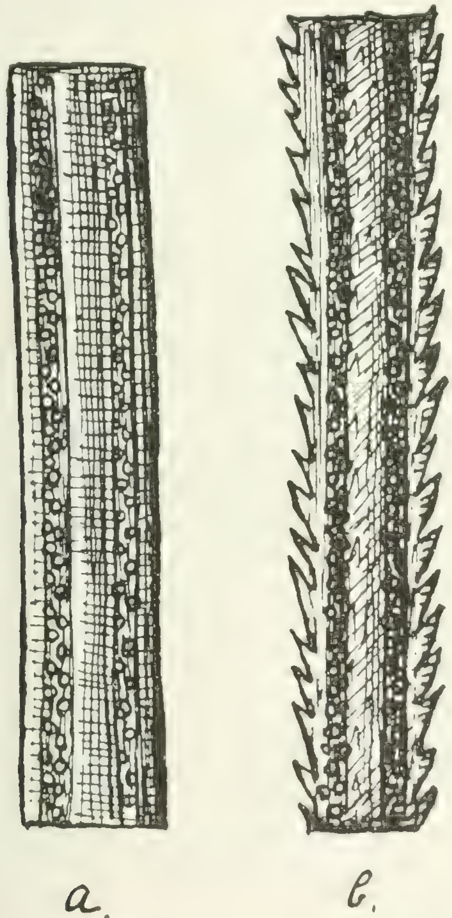
In support of these statements we have only to exa-

* Refer to literature cited on last page.

mine the beard of a smooth-bearded barley. These beards are so smooth that they may be drawn over the face in either direction without roughness being apparent except perhaps near the tip.

The question may be raised: "Why not remove the beard entirely and thus do away with the barb?" In answer, it may be said that many successful attempts have been made, with the result that many varieties of beardless barleys have been produced. It is unfortunate, but true, however, that in every instance, at least so far as it has been possible to ascertain, the net result is to improve the handling and feeding qualities of the barley at the expense of its productiveness. There is a strong feeling too, among plant physiologists, that the beard is an essential organ to the barley plant and to remove it interferes with the vital processes of the plant, thus reducing production.

Zoebl and Mikosch (2) in 1892 showed that the awn of barley was an organ of transpiration. Schmid (3) in 1898 and Perlitus (4) in 1903 elaborated the experiments of Zoebl and Mikosch. Tedin of Sweden (5) also made observations which point to the important physiological function of the awn. These investigators are



Section of (a) *smooth and* (b) *rough awns of barley* (*after Regel*).

agreed that the awn is an organ of transpiration and all showed the effect of its removal on the kernel.

Another very exhaustive piece of research that bears out these facts is that of H. V. Harlan and S. B. Anthony (6). The following summary statement is given by these investigators:—

"The removal of the awns from a barley spike has a marked effect on the development of the kernels of the spike.

"Kernels from clipped spikes have smaller volume and a lower weight of dry matter at maturity than do those from normal spikes.

"The difference is not due to the injury of shock in removing the awns; the kernels in the clipped spikes develop as rapidly as those in the normal spikes for several days after the awns are clipped.

"About one week after flowering the deposit of dry matter in the kernels of the normal spikes begins to exceed that in the kernels of the clipped spikes. This is about the time that rapid infiltration begins.

"In normal spikes at Aberdeen, Idaho, the awns contained more than 30 per cent of ash at maturity. When the awns were removed a part of this ash apparently was deposited in the rachis. The rachises of the clipped spikes contained about 25 per cent. more ash than the rachises of the normal spikes."

Since the plant physiologist has by these facts clearly shown that the beard is an essential organ in optimum development in the barley kernel, the plant breeder must accept these and act accordingly.

It seems reasonable to conclude, therefore, that the removal of the beard or awn will not be the most economical method of solving this serious menace to the barley crop. Some other means must be employed, and the plant breeder has chosen that the better alternative is to preserve the beard or organ of respiration but remove if possible, its objectionable roughness, the barbs or teeth.

We believe that the production and distribution of a barbless or smooth-awned barley will create nothing short of a great boon to the barley crop—it will popularize it. It is our conviction that yield being equal, farmers would prefer the barbless bearded or smooth-awned barley and, if a high yielding one can be found the acreage devoted to barley in northern areas in Western Canada will be increased many fold.

Smooth-awned barleys are not new. Koernecke (7), described the liorrhynchum form in 1882. He also described medicum and persicum, both 2-rowed sorts that were found in mixtures of barley in Asia Minor. Robert Regel in Russia published a monograph on smooth-awned barleys in 1909.

The Office of Cereal Investigation of the United States Department of Agriculture has studied these forms for several years. Much breeding work has been carried out co-operatively between the Minnesota Station and the United States Department of Agriculture, with fair results. Many smooth-awned forms have been introduced from Russia, Algeria and Asia Minor through the Office of Foreign Seed and Plant Introduction and used in breeding experiments to produce productive smooth-awned varieties.

Most of the breeding work in America has been conducted at St. Paul, Minn.; Arlington Farm, Virginia; Chico, Cal.; Aberdeen, Idaho; and Moro, Oregon. For the most part, however, high yielding sorts have not as yet been produced. During the summer of 1918 barley breeding work was undertaken by the Department of Field Husbandry, University of Alberta, with the end in view of producing a smooth-awned barley, which would be suited to conditions in Alberta. Some forty or fifty crosses were made, using the smooth-awned parents, Lion and hybrids obtained from Minnesota, on our most productive 6-rowed and 2-rowed varieties, O. A.C. #21 and Canadian Thorpe respectively. Our results so far are very encouraging. A large number of promising crosses have been carried forward to the third generation, by the aid of greenhouse facilities.

These bid fair to render a service to interested and prospective barley growers.

In planning this work it was felt that Alberta as a livestock producer would turn its attention more and more to the growing of feeds suitable for the production of beef, mutton and pork. If barley, the corn crop of Alberta, was to be grown as a grain crop, it seemed imperative that it must be made more popular among the growers. The logical thing to do, therefore, was to remove the barbs or teeth from the beard and yet preserve the head, so that its productive power might not be impaired.

Literature Cited.

(1) Bulletin of Agricultural Statistics. Dept. of Agr., Ottawa.

(2) Zoebl, A., and Mikosch, C.—Die Function Der Grannen Der Gerstenahre. In Sitzber, K. Akad, Wiss. (Vienna), Math. Naturw. Cl., Bd. 101, Abt. I, Heft 9/10, p. 1033-1060, 1892.

(3) Schmid, B. Bau Und Funktionen Der Grannen Unserer Getreidearten. In Bot. Centbl., Bd. 76, p. 39, 75, 119, 218, 305-307, 1898.

(4) Perlitus, Ludwig. Einfluss Der Begrannung Auf Die Wasserverdunstung Der Aehren Und Die Kornqualitat. 77 p., 3 pl. Breslau, 1903.

(5) Tedin, Haus. Averiges Usadeforenings, Tidsdrift, Year XXVI, pt. 6, pp. 245-253. Malmoe, 1916.

(6) Harlam, H. V. and Anthony, S. B. Development of Barley Kennels in Normal and Chipped Spikes and the Liimtations of Awnless and Hooded Varieties. Journal of Agr. Research, Vol. XIç, No. 9, Wash. D.C. Aug. 2, 1920.

(7) Harlan, H. V. Smooth Awned Barleys. American Society of Agronomy, Vol. 12., Nos. 6 and 7.

The Development of Entomology in Saskatchewan

By A. E. CAMERON, Professor of Zoology, University of Saskatchewan.

Review of Progress.

The history of the earlier phases of entomological work in the province of Saskatchewan will always be indissolubly linked up with the activities of the late Professor T. N. Willing, whose recent lamented death removed the pioneer entomologist of this province. Despite the fact that Mr. Willing was for the greater part of the time of his association with the Provincial Department of Agriculture and latterly with the University of Saskatchewan, unassisted in his endeavors, he continued to accomplish work of such value that our entomologists of the future will be able to reap the benefits of his labours.

In addition to the extensive collection of insects which he had built up, Mr. Willing acted in an advisory capacity in those cases where crops were being affected by the ravages of injurious species. As an indefatigable collector he was unsurpassed and he has laid us under a deep debt of gratitude in presenting his collections, the fruits of many years' work, to the University. By his activities throughout the province it may be justly said that he was chiefly instrumental in establishing in the minds of the agriculturists the value of a knowledge of the methods of economic entomology. Perhaps, apart from his own innate interests in his work, the only other factor which stimulated his efforts, were the yearly visits of the late Dr. James Fletcher, Dominion Entomologist, by whose energy was secured the official recognition of the needs of economic entomology in Canada.

Although the Dominion Entomological Branch had established field laboratories and had been represented by one of its officers in nearly all the provinces of the Dominion, for several years, Saskatchewan had been neglected in this respect until 1917 when the Federal Entomological Branch decided to delegate one of its officers to this province. It had not been intended that his stay should be a permanent one, but in virtue of the many interesting entomological problems that arose at that time, an agreement was made between the University authorities and the Federal Department of Agriculture whereby the Entomological Branch should have a permanent representative in the province and that he should be associated with the University. In exchange for certain concessions of accommodation for entomological work made by the University, the federal representative undertook the teaching of entomology in the University, and this class has been presented as part of the regular biological course in the department of Biology for the past three years.

Although not the stated policy of the Federal Entomological Branch, it has been more or less intended that the representative in charge of entomological work in any single province should devote his time principally to research work on any entomological problem that might appear to require development from time to time. In the Western Provinces, however, the duties of the entomologist have been much more extensive, and owing to the fact that he was generally working unaided, and demands for his advice in regard to the control of some particular injurious insect might be incessant, he had to undertake a large amount of extension work carried on both by correspondence with the farmers and by personal visits to infested areas. It will be quite readily realized that in a large territory such as that of the Province of Saskatchewan, very little organized work throughout the length and breadth of the province could be attempted with limited assistance, and it was practically impossible for one individual to keep in touch with all the outbreaks of injurious insects that might be taking place in the outlying districts.

Such was in brief the condition of the interests of the province in entomology at the time of the sudden outbreak of grasshoppers in 1918. Through nobody's fault, the province was caught unawares, and so far as I know the representative of the Federal Entomological Branch was the only individual in the province at that time who had any experience in the tackling of an important field problem in entomology and who was prepared to prescribe the necessary measures of control. The plague of grasshoppers has caused thousands of dollars of loss to cereal crops in the short time of its devastating activities, but I for one will always

correlate the time of its appearance with the real awakening in this province of interest in entomology as a subject for serious study.

At the present time we have but touched the fringe of the entomological problems that face us in Saskatchewan and in the prairie provinces generally. Our ignorance of the most common species of insects of economic importance is colossal, and agriculturists who have heretofore considered that entomological work is merely a minor adjunct of the other branches of agriculture, such as agronomy, horticulture and animal husbandry, have begun to realize their mistake. At present all our efforts are being concentrated in an effort to reduce the grasshopper to a state of impotence, and we are thus likely to forget that cutworms, —to mention but one other instance—which are more insidious in their destructiveness, are the causative agents on crop-losses from year to year that compare favorably with those caused by the grasshoppers. Further, the problems of the trained entomologist are not confined solely to the protection of our crops; in the realms of veterinary and medical entomology there are urgent demands for scientists equipped with the necessary training to investigate injurious species that are detrimental to stock and to human welfare. Within the limits of our province there occurs a wide variety of bot-flies, horse-flies, black-flies and mosquitoes, not to mention such internal parasites as the recently arrived tapeworm of "staggers," all of which are serious inhibiting agents in the extension of human endeavors. These and many other examples could be cited that await investigation, and the solution of their control can only be attained by the zoologist or entomologist who has had the necessary scientific training and is sufficiently well-equipped mentally to carry out biological research of the highest quality.

The Training of the Entomologist.

To many of us it may not have been surprising that when a demand for helpers in the grasshopper campaign was made by the Provincial Department of Agriculture, not a single field assistant could be obtained who had received any special training in entomology. Such men could certainly not be found in the province. While nothing but praise can be offered to the Department for the manner in which it has faced the problem, it is now time that an attempt was made to remedy this state of affairs. Naturally, in all matters pertaining to technical training we must look to the University as the centre of learning in the province, and although I speak without authority, I am sure that if it can be plainly shown that there is a need for an extension of entomological teaching, the University will submit the question to its sympathetic consideration.

It has been already indicated that a class in entomology has been carried on during the past three years in the University, but an examination of the class-records show that a very small percentage of agricultural students have attended the course. The members of the class have been mainly drawn from the students of the Faculty of Arts, and in virtue of the already crowded curriculum, the numbers have been comparatively small. This year there is but one agricultural student proceeding to the B.S.A. degree that has elected the class as one of his subjects. At present entomology constitutes but half-a-course in Parasitology. It is our aim in these two subjects to make the students acquainted with the more common injurious animal pests, so that they may learn something of their biology and the means whereby they may be recognized. The methods of control are also indicated, and whilst the economic aspects of the subjects are stressed, a certain part of the time is devoted to the study of the subjects on the systematic side.

With the time at our disposal, it would be impossible to attempt to turn out finished entomologists and parasitologists, but I am perfectly certain that those students who have applied themselves diligently to the work of the class, would be of excellent service to the provincial department in its duties of controlling injurious insects. I would therefore recommend that agricultural students proceeding to a degree should be advised to attend these courses and that means be provided for the extension of the possibilities for advanced work in those cases where students might choose to specialise in entomology. To my mind this would provide a solution for the present dearth of trained workers in the field of entomology.

The lack of trained entomologists is a problem that affects not only Saskatchewan but the country at large. Just at present the Federal Department of Agriculture is experiencing the greatest difficulty in finding a suitable candidate to take over the position of Entomologist in Saskatchewan which lately became vacant. The reason for this is not far to seek. The training of the entomologist is a long and arduous one and amongst other qualifications he must show an aptitude for carrying on original research work. His training must not be one-sided. In addition to the purely cultural subjects, he should have more than a speaking acquaintance with the whole field of biology as well as the related sciences of physics and chemistry. The problems he is asked to investigate are of such a varied nature that he must be prepared to draw upon all the basic sciences for the funds of his information if he intends to advance the bounds of human knowledge. It is not sufficient then that he should be interested merely in entomology in order to satisfy an ambition to acquire an entomological position. He should know something of all the sciences and everything of entomology when his academic training is completed and he is ready to face the realities of entomological problems in the field. His course should not be so heavily weighted on the systematic side as to exclude the practical. The chances are that whereas he may know all that can be learned of the characters that distinguish one species from another in the laboratory, the first question with which he is met in the field will refer to the best brand of lead arsenate that should be used in the control of some injurious insect.

The emoluments that are attached to our entomological positions have always been more or less inadequate when one comes to consider the time necessary for acquiring the proper training and the importance of the service given to the community by the entomologist. It is therefore scarcely to be wondered at that there are comparatively few scientists who choose to follow up a course in entomology.

The Relation of the Federal Entomologist to the Provincial Department of Agriculture.

It has already been indicated that it has been the unwritten policy of the federal Entomological Branch that their representative should confine his attentions to original research work in the provinces to which they have been delegated. In most cases he has also acted in an advisory capacity among the agriculturists at large and to the provincial department of agricul-

ture when his advice has been sought. Several of the eastern provinces now possess a provincial entomologist of their own, but up to the present none of the western provinces has made a special entomological appointment except that an entomologist may be attached to the staffs of the provincial universities and colleges. So far as I am aware there is no provincial entomologist either in the departments of agriculture or in the universities or colleges of Manitoba, Alberta, Saskatchewan and British Columbia, and the greater part of the Entomological work that has been accomplished in the western provinces has been mainly carried on by the federal entomologists who are designated "Entomologists in Charge." In the west, with the exception of British Columbia, no working arrangement exists between the federal and provincial forces in the field of entomology. In this latter province the federal entomologist has practically been given full charge of all entomological work and he has the supervision of the activities of a staff of assistants from the provincial departments of agriculture. In this particular case events have shown that the arrangement has worked admirably, and entomologically speaking, British Columbia is at present much stronger than any of the other western provinces.

Such an arrangement will, of course, always depend for its success on the personality of the chief parties concerned, and where everything else is equal, I can see no reason why the two departments may not cooperate in other provinces with an equal measure of success, and with equally happy results. Under such an arrangement the Federal Government supplies the trained entomologist who is capable of advising and directing entomological work in the province, whilst the provincial department supplies the sinews whereby that work may be carried out in the field. In virtue of the fact that the provincial department by means of its representatives is more directly in touch with the agricultural developments of the province, the federal representative has a ready means of learning the immediate happenings of insect outbreaks in different parts of his territory and is also able to bring the necessary remedies to bear in order to cope with a particular situation. At the same time,—and I do not present this as an argument in favor of this kind of cooperation,—the provincial department is denied the opportunity of maintaining a trained entomologist.

Necessity for Fostering Entomological Work.

The problems of insect control are intimately related to agriculture, horticulture (including fruit-growing), forestry, public health and other human activities; in proportion as these activities extend the bounds of their importance, the knowledge of the means of insect control also increases. It is no exaggeration to say that the province is being annually mulcted several hundreds of thousands of dollars by reason of the depredations of insect pests. We have authoritative statements that indicate an annual loss of ten to twenty-five per cent of the value of our farm crops due to the activities of harmful insects. Further, it is safe to say that even with our present knowledge of the methods of insect control, a saving of at least thirty per cent could be effected, and with increased knowledge this percentage will undoubtedly increase. All should realise that it is a poor policy that advocates an increase in the productivity of the soil, if at the same time, attention is not paid to the means whereby these factors that are responsible for the reduction in crop-yields may be eliminated or rendered negligible.

The great extent of the province of Saskatchewan, including as it does widely different climatic conditions, implies a very considerable variety of insect life. In addition to variety, it involves no little difference and possibility of difference in the behavior of the same species of insect in different parts of the province. One of the facts which to my mind is the most interesting in relation to insect-life is the gradual disturbance of the natural conditions due to the bringing under cultivation each year of thousands of acres of hitherto virgin land. Insects have been ever responsible to any disturbances of nature's balance, and the provision of large areas of cultivated crops often causes them to abandon their native food-plants for the more abundant new source of food supply, with consequent detrimental results to agricultural interests. An abundance of luscious food, other factors being equal, always means a prolificness in the reproduction of insect pests, and a consideration of these questions has a strict bearing on the periodic outbreak of grasshoppers, cutworms, wheat-stem sawflies and innumerable other insects.

The question of control does not always resolve itself into one of careful watch of our native insects, but some of the worst pests within our territory have been imported at one time or another from alien countries and they vie with our native species in an enviable record of destructiveness. In this respect we have but to mention the Hessian Fly, the Wheat Midge and the Colorado Potato Beetle.

PROVINCIAL HORTICULTURIST APPOINTED IN B.C.

We learn with pleasure and interest, of the appointment of W. H. Robertson (O.A.C., 1911) to the position of Provincial Horticulturist for British Columbia. Mr. Robertson has been in the employ of the Department of Agriculture at Victoria since 1912, except for a period of three years (1916-1919) during which he was overseas.

Since the resignation of Mr. M. S. Middleton as Provincial Horticulturist, some three years ago, there has been no successor appointed until now. The result has been a noticeable need for the proper direction of horticultural work in the various districts into which the Pacific province is geographically divided. There have been district horticulturists on Vancouver Island, the lower Mainland and in the Okanogan Valley, but there has been no official bureau for the proper direction of the work in these districts, and it has consequently been conducted in a more or less haphazard way. The need for the appointment of a provincial horticulturist, for these as well as for other reasons, has been strongly felt.

We feel that the appointment of Mr. Robertson to this position will be popularly received, and that, under his direction, rapid progress will be made towards the improvement of horticultural conditions and the solution of horticultural problems. The fruit and vegetable industries of British Columbia are of national importance, and their value is increasing rapidly year by year. The appointment of a provincial horticulturist will materially aid in caring for these branches of the agricultural industry, and in encouraging the use of modern methods of producing and marketing.

Concerning the C. S. T. A. and Its Branches

BY THE GENERAL-SECRETARY.

The First Annual Convention will be held at the Royal Alexandra Hotel on June 15, 16 and 17, 1921.

On and after June 2nd, until June 18th, the address of the General Secretary will be at the place of the Convention. All communications should be sent there and will receive prompt attention.

Every member who attends the Convention, whether he is a delegate or not, should come prepared to express an opinion upon the matters appearing on the programme (See page 162 of last issue). The opinions of the members direct the policy of the Society.

Official Delegates.

Up to the time of going to press (May 20th) the following official delegates have been appointed from their respective provinces.

Alberta.—H. A. Craig, Deputy Minister of Agriculture, Edmonton, T. O. Clark, Soldiers Settlement Board, Edmonton.

British Columbia.—R. C. Treherne, Dominion Entomological Laboratory, Vernon; G. G. Moe, University of B. C. Vancouver; A. F. Barss, University of B. C., Vancouver.

Manitoba.—T. J. Harrison, Agricultural College, College, Winnipeg; V. W. Jackson, Agricultural College, Winnipeg.

Nova Scotia.—George Sanders, Dominion Entomological Laboratory, Annapolis Royal.

Ontario. — J. B. Reynolds, President of the O.A.C., Guelph; J. E. Howitt, Professor of Botany, O.A.C.; W. J. Bell, Agricultural School, Kemptville; R. Innes, S.S.B., Ottawa; R. S. Hamer, Live Stock Branch, Ottawa; L. H. Newman, Secretary, Canadian Seed Growers Association, Ottawa.

Quebec.—A. T. Charron, Provincial Chemist, St. Hyacinthe; J. N. Ponton, 63 William St., Montreal; Jules Simard, Dominion Seed Branch, Quebec; L. P. Roy, Department of Agriculture, Quebec; Georges Bouchard, Ste. Anne de la Pocatiere; H. Barton, Macdonald College; L. C. Raymond, Macdonald College.

Saskatchewan.—W. P. Thompson, University of Saskatchewan, Saskatoon; J. G. Robertson, Live Stock Commissioner, Regina.

Applications for Membership.

Désilets, A. (Laval, 1915, B.S.A.) Department of Agriculture, Quebec, P.Q.

Dickey, C. M. (Toronto, 1920, B.S.A.) Sussex, N.B.

Héon, Henri, (Laval, 1919, B.S.A.) Riviere du Loup, P.Q.

Jenkins, G. J. (Toronto, 1913, B.S.A.) Toronto, Ont.

Lavoie, J. H. (Laval, 1910, 1913, B.S., I.F.) Department of Agriculture, Quebec, P.Q.

Michaud, G. E. (Laval, 1919, B.S.A.) Department of Agriculture, Moncton, N.B.

Ross, N. M. (Toronto, 1898, B.S.A.) Indian Head, Sask.

Cloutier, J. B. (Laval, 1916, B.S.A.) Department of Agriculture, Quebec, P.Q.

Hutton, G. H. (Toronto, 1900, B.S.A.) Department of Natural Resources, C.P.R., Calgary, Alta.

The total membership on May 15th was 558.

Changes in Addresses.

Brisebois, E., Ste. Hénédine, P.Q.
J. R. Brassard, Pierreville, P.Q.
A. Charbonneau, Joliette, P.Q.
C. Lyster, 605 Dorchester St. W., Montreal, P.Q.
H. D. Mitchell, Ford Motor Co., Montreal, P.Q.
L. F. Burrows, Fruit Branch, Ottawa, Ont.
W. A. DeLong, Agricultural College, Truro, N.S.

The Convention Programme.

The tentative programme published on page 162 of the last issue remains unchanged, and will, with minor changes, be followed. Some other matters of business will be added. Consideration will be given to the question of admitting associate members to the Society; these would be permitted to attend meetings without voting powers, and would, in general, admit men engaged in agricultural work who were not eligible to full membership.

The extent to which Government employees will be permitted to co-operate with Canadian manufacturers has also been suggested as requiring discussion and will be given a place on the programme.

Any member is free to suggest to the General Secretary any matter he wishes to bring before the Convention. Full consideration will be given, and members are invited to send in their opinions.

Manitoba Branch.

The annual business meeting of the Manitoba Branch of the C.S.T.A. was held in the St. Charles Hotel, Winnipeg on May 13th, taking the form of a luncheon.

The Hon. G. J. Malcolm, Minister of Agriculture addressed the meeting, expressing the wishes of the Provincial Department of Agriculture for a successful convention in June and emphasizing the importance of a society such as the C. S. T. A. which is endeavouring to bring together the men who are working in the interests of progressive agriculture in Canada. The election of officers for the coming year resulted in the following:

President, Harris McFayden; Vice-Pres., Prof. G. R. Bisby; Sec.-Treas., A. C. McCulloch.

Prof. V. W. Jackson and Prof. T. J. Harrison were elected as official delegates from the Province of Manitoba to attend the Winnipeg convention.

Canadian Society of Technical Agriculturists

CONSTITUTION AND BY-LAWS.

NOTE.—Clauses printed in black type will be given special consideration at the First Annual Convention. Every member should become familiar with the various clauses and, if he wishes, may make any suggestions to the General Secretary, for reference to the Convention. Such suggestions and recommendations should be addressed: Fred. H. Grindley. Royal Alexandra Hotel, Winnipeg, Man. The dates of the Convention are June 15, 16 and 17, and the General Secretary will be at the above address on and after June 4th, until the close of the Convention.

CONSTITUTION.

ARTICLE 1.

Name.

The organization shall be known as the Canadian Society of Technical Agriculturists.

ARTICLE 2.

Objects.

The objects of the Society shall be the following:

(a) To organize and unite all workers in scientific and technical agriculture, so that they may combine effort to promote the scientific and practical efficiency of the profession and to make the profession of increasing service to the agricultural industry.

(b) To maintain high standards in the profession.

(c) To encourage a national policy of agricultural research.

(d) To help to procure for scientific work in agriculture greater financial support and wider fields of usefulness.

(e) To aid in securing and maintaining a closer co-operation among all workers engaged in the profession of agriculture in Canada, and the better co-ordination of their work.

(f) To aid in bringing about a closer co-ordination between the profession as an organized body and the various agricultural associations throughout Canada.

(g) To serve as a medium where progressive ideas for improvements in agricultural education, investigation, publicity and extension work can be discussed, formulated and recommended for adoption when deemed advisable.

(h) To aid in ensuring the employment of technical men for technical positions.

(i) To issue publications in the interests of Agricultural science.

ARTICLE 3.

Membership.

There shall be two classes of members, regular and honorary.

1. Eligibility requirements for regular members shall be as follows:—

(a) Every member must be a graduate in Agriculture from a University or College of recognized standing, or

(b) A graduate of a University or College who is engaged in agricultural research, administration, education, extension work, publicity, experimental problems, or other forms of allied work of a scientific or managerial nature, or

(c) Engaged in agricultural research, administration, education, extension work, publicity or experimental problems, and be accepted as provided for in the by-laws.

2. The Honorary members' class shall be composed of persons not eligible for regular membership who have rendered the profession valuable or special service. They shall be selected as provided for in the by-laws.

3. From the regular members there shall be chosen a body of "Fellows," not exceeding thirty in number. The title "Fellow" shall be granted for professional distinction only, and be bestowed as provided for in the by-laws.

ARTICLE 4.

Officers.

The officers of the Society shall be a president, first and second vice-president, and honorary secretary-treasurer, who, together with one member of each provincial executive, shall form the Dominion Executive of the Society.

ARTICLE 5.

Organization.

The organization of the Society shall be:

(a) The Dominion Executive, consisting of the officers and members provided for in Article 4.

(b) The Provincial Executives.

(c) The Local Branch Executives.

ARTICLE 6.

Management.

The affairs and business of the Society shall be managed by such officers and committees and under such restrictions relating to the duties and powers of such officers and committees as may be provided for in the by-laws, such by-laws to make provision for the employment of a paid General Secretary-Treasurer.

ARTICLE 7.

Meetings.

There shall be an annual Convention of the Society and this shall be held alternately in Eastern and Western Canada.

Meetings of the Dominion Executive or meetings called by it shall be arranged as may be necessary to carry out the objects of the Society, where not specified in the by-laws.

Local organizations may hold meetings as provided for in the by-laws.

QUORUMS.—One-third of the members of the Dominion Executive or of any branch Executive shall constitute a quorum for the transaction of business, and at any meeting of any branch one-fifth of the enrolled members shall be considered a quorum for business or other purposes.

Place of meeting. The place of meeting for the following year shall be fixed at each annual Convention.

ARTICLE 8.

Fees.

The amount, apportionment, and method of collection, of the annual dues shall be regulated by By-law.

ARTICLE 9.

Elections.

The four main officers of the Society shall be elected at large as provided in the By-laws. All officers shall be eligible for re-election. Vacancies shall be filled by appointment by the Dominion Executive or by nomination and election at any regular or special convention.

ARTICLE 10.

Order of Business.

The order of business at all Conventions of the Society or meetings of the Dominion Executive shall be as follows:—

(a) Minutes.

(b) Business arising out of the minutes.

(c) Correspondence.

(d) Reports of Committees.

(e) Unfinished Business.

(f) Election of Officers and Committees.

(g) New Business.

(h) Resolutions.

This order may be varied at any meeting by a two-thirds vote of the delegates present.

ARTICLE 11.

Standing Committees.

Within one month from the date of the Annual Convention the Dominion Executive shall appoint any Special or Standing Committees of the Society as required by By-law. Nominations for such Committees may be made by any members or by the Nomination Committee at the date of the Annual Convention.

ARTICLE 12.

Changes of Constitution.

This Constitution may be amended at any Convention of the Society by unanimous vote or by a majority vote at two consecutive conventions.

By-Laws

ARTICLE I.

Membership.

1. The Society is Canadian, but Canadians resident in other countries are eligible for regular membership. Citizens of foreign countries are eligible for honorary membership.

2. Applications for regular membership must be made in writing to the Secretary of the Local Branch for recommendation to the Membership Committee of the Dominion Executive.

3. "Fellowships" are granted upon recommendations made by the Dominion Executive or a subcommittee of that body, after such recommendations have been passed upon and confirmed by a two-thirds vote of the delegates at any annual convention. Any regular member may make recommendation for a fellowship through the prescribed channels.

It shall be provided however that until all the vacant "fellowships" are filled, not more than 5 may be appointed at any one Annual Convention.

4. Honorary members may be elected upon nomination by the Dominion Executive at any Annual Convention after acceptance by a two-thirds vote of the delegates.

5. Members, who in the opinion of the Dominion Executive have failed to maintain the dignity of the profession may be recommended for suspension by that body, but such recommendation, before being put into effect, will require to be substantiated by a two-thirds vote of the delegates present at the next Annual Convention.

ARTICLE II.

Duties of Officers.

The President and other officers shall perform the usual duties of their respective offices. The President shall also deliver an address at each Annual Convention.

ARTICLE III.

Organization.

1. Hereafter, no one shall be eligible for the Dominion Executive who has not been a member of the Society for one year.

2. The Dominion Executive shall be the business body of the Society and as such shall transact all general business of the organization. It shall appoint the General Secretary-Treasurer, who shall receive a salary to be decided on by itself.

It shall be responsible that all Standing Committees function in a manner satisfactory to the best interests of the Society.

3. Upon the application of 20 members, the Dominion Executive may permit the formation of a Local Branch providing, however, that there shall be at least one Local Branch in each Province, irrespective of the number of members in that Province. Such locals shall be governed by Constitution and By-laws formed in general after the Constitution and By-laws of this Society. A copy of each local and Provincial Constitution shall be sent to the Dominion Executive, which must approve it before it is valid.

4. Where there are two or more locals in any Province, these Locals shall form a Provincial Executive through which all dealings with the Dominion Executive must be conducted. The first Provincial Executive shall consist of the President, Vice-President and Secretary-Treasurer of each Local and shall proceed to effect the organization of their own Province.

ARTICLE IV.

Meetings.

1. The Fiscal Year of the Society shall commence on June 1st of each year, and the Annual Convention shall be held within the next three weeks from that date. It shall be convened in such city as may be decided upon at the preceding Annual Convention.

2. Each Local Branch shall be entitled to send one delegate for every 20 members and any majority fraction of 20 members.

3. Except where otherwise specified in the By-laws, all voting at conventions is reserved for official delegates.

4. The Dominion Executive may call such other conventions of the Society as may be necessary to carry on efficient work.

5. Local Branches shall hold meetings as arranged by their Executives.

6. The Dominion Executive shall meet when and where they may decide, providing that at least two such meetings are held annually.

7. Notification of the place and date of the Annual Convention shall be sent by mail to each Provincial Executive at least two months before it is to be held.

Notification of the place and date of Provincial Executive Meetings shall be according to their own By-laws.

Notification of the place and date of Dominion Executive Meetings shall be sent by mail to each member of the Executive at least one (1) month before it is to be held together with agenda of business to be considered, apart from that of a routine nature.

ARTICLE V.

Fees.

The membership fee of the Society shall be $10.00 per annum, payable on the 31st of May. This fee shall be forwarded to the General Secretary.

ARTICLE VI.

Funds.

Funds for the purpose of the Society may be raised by assessment upon each regular member by the Finance Committee, provided that a four-fifths affirmative vote of the registered delegates at any Annual Convention shall be obtained.

ARTICLE VII.

Elections.

1. Nominations for President, 1st Vice-President, 2nd Vice-President and Honorary Secretary-Treasurer shall be valid if received by the Secretary of the Dominion Executive on or before March 31st, provided they are signed by 10 regular members in good standing.

2. The election of these officers shall be conducted on the Proportional Representation System, and shall be by mail ballot, every regular member in good standing shall be entitled to cast one ballot which shall be sent out by the General Secretary not later than April 10th, and these shall be counted by a Committee consisting of the General Secretary, one member of the Dominion Executive and a third party, not a member of the Society, who shall be selected by the Dominion Executive.

3. All ballots shall be the regular form of ballot used by the Proportional Representation Society of

Canada. These shall be supplied together with one "voting envelope" and one "identification envelope." On the face of the "voting envelope" the following shall be printed:—

(a) "Do not write anything on this envelope."

(b) "After marking your ballot enclose it in this envelope and seal."

(c) "Put this envelope (your ballot envelope) into the identification envelope."

(d) "Write your name and address plainly on the upper left-hand corner of the identification envelope."

(e) "Return your ballot enclosed in the two envelopes to the General Secretary."

ARTICLE VIII.

Committees.

1. The Committees of this Society shall be:—

(a) On Membership.

(b) On Finance.

(c) On Progress.

Which shall be sub-committees of the Dominion Executive.

(d) Research.

(e) Publications.

Which shall be Standing Committees, together with such others as may be deemed necessary.

(f) On Conventions.

Which shall be appointed by the Dominion Executive.

(g) On Resolutions.

(h) On Nominations.

Which shall be nominated and elected by and for each Convention, together with such other temporary committees as may be necessary for the efficient working of the Convention.

(i) Such permanent committees as may be appointed by each Convention to act upon its decisions.

2. The personnel of the Standing Committees shall be reviewed by the Committee on Nominations at each Annual Convention, which committee shall make recommendations for re-appointments and re-organization of all Standing Committees. Other committees shall be elected at each Annual Convention, or shall be appointed by the Dominion Executive.

3. It shall be customary, but not obligatory, that the Chairman of each Standing Committee shall be a member of the Dominion Executive. Each Committee shall consist of at least three members with power to add to their number.

4. The duties of the Committees shall be as follows:

(a) The Membership Committee shall receive, consider and pass upon all applications for membership and resignations of membership. It shall have power on behalf of the Society to deal finally with same. At its discretion it may delegate that power to the Dominion Executive.

(b) The Progress Committee shall devise means for stimulating the interest of the members in the work of the Society and shall actively interest itself in securing new members and new locals. It shall consider new plans and policies for the Society.

(c) The Publications Committee shall take charge of any publications of the Society, and shall recommend to the Dominion Executive an editorial policy for same.

(d) The Research Committee shall investigate the possibilities for research work by the members of the Society.

ARTICLE IX.

Auditors.

Auditors shall be appointed each year at the Annual Convention, whose duty it shall be to audit the books of the Society, to certify to the correctness of same, and to undertake any further work attached to the work of auditing the accounts of the Society.

ARTICLE X.

Amendments to By-Laws.

The By-laws of this Society may be amended or added to by a majority vote of the delegates present at the Annual Convention or by a four-fifths majority of the members of the Dominion Executive subject to approval at the next Convention;

Provided that, in the first case, notification of the proposed amendment is sent to the General Secretary before May 1st.

The General Secretary shall forward copies of all proposed amendments to the Secretary-Treasurer of each Provincial Executive.

La Revue Agronomique Canadienne

Section Française de l'Organe Officiel

DE LA

Société des Agronomes Canadiens

Rédacteur: F. Létourneau.

Le Facteur Intelligence

LES CADRES D'UN ENSEIGNEMENT AGRICOLE.

On parle beaucoup, depuis quelque temps, au sein du Parlement, du Conseil de l'Instruction Publique, dans le peuple, d'enseignement agricole. Peut-être, conviendrait-il, en attendant que le comité dont nous parlons ailleurs se prononce sur le sujet, de mettre, sous les yeux de ceux qui rêvent de développer l'enseignement agricole, les cadres dans lesquels ils devront travailler, d'établir les bases sur lesquelles ils devront construire, si réellement ils désirent que leurs fils n'aient pas à subir des fatalités artificielles du genre de celles que nous subissons aujourd'hui et créées par nos prédécesseurs.

Le facteur intelligence est le facteur le plus important de la production agricole. Que voit l'homme intelligent en face d'une ferme bien cultivée, moderne, administrée par un cultivateur qui pense, qui raisonne? Il voit d'abord de la science. Les découvertes de Liebig lui reviennent à la mémoire. Celui-ci, en effet, écrit le professeur Nagant, découvrit, avec le mode de nutrition minérale des végétaux, la relation qui existe entre le rendement des récoltes et la composition chimique des sols. Il enseigna comment on pouvait améliorer cette composition des sols, rétablir leur fertilité par l'apport de substances minérales dont il existait, dans certains endroits du globe, de grands gisements inutilisés jusqu'alors. L'emploi de ces matières minérales, désignées généralement sous le nom d'engrais chimiques, vint révolutionner la culture, en amenant la solution du problème de la restitution et en instaurant les méthodes de culture intensive. L'immortel Pasteur passe devant ses yeux. Depuis une trentaine d'années, poursuit M. Nagant, nous sommes entrés dans une nouvelle ère de progrès, résultant des fameuses découvertes de Pasteur, le créateur de la microbiologie. Une foule de phénomènes, restés inexpliqués par la chimie inanimée ont été élucidés lorsqu'il fut démontré qu'ils étaient le résultat de l'activité de ces infiniment petits, dont on ne soupçonnait pas le rôle auparavant. Dans les laboratoires et les stations de recherches de tous les pays, de savants disciples de Pasteur se mirent en devoir d'étudier, par de patientes observations, les synthèses étonnantes et les analyses compliquées qu'opèrent ces myriades d'extraordinaires petits chimistes, dans le mystère profond du sol arable, laboratoire ténébreux, aux recoins innombrables, où chacune de leurs catégories travaille dans des conditions particulières, s'attaquant à certaines substances, dans un sens déterminé, pour les passer à d'autres groupes de petits sorciers qui continuent ou achèvent les transformations, tout comme dans les ateliers de mécanique les plus compliqués, où la division du travail est poussée à l'extrême, le lingot d'acier brut passe par cent mains et cent machines différentes, pour apparaître enfin à l'état d'objet fini.

Parmi les faits capitaux mis en lumière, dans l'étude de la microbiologie, appliquée à l'agriculture, il faut mentionner la découverte de la conversion, dans le sol, des principes azotés, en nitrates; le mode spécial de nutrition de certaines plantes, aux dépens de l'azote atmosphérique, grâce à l'intermédiaire du fameux *"bacillus radicola"*, qui envahit leurs racines et leur passe le précieux élément que constitue l'azote, que lui seul est capable de fixer à l'état de combinaison, en retour d'autres matières nutritives fournies par la plante nourricière. Que voit-il encore notre homme? Que ses yeux tombent sur les récoltes de cette ferme moderne et tout un monde de chercheurs, d'expérimentateurs, de savants se lèvent dans son esprit. Il se rappellera peut-être avoir lu ce passage de Fabre, l'Homère des insectes, adressé à ses neveux:

"Vous vous figurez que de tout temps les choses ont été ce qu'elles sont aujourd'hui; vous croyez, en particulier, qu'en vue de votre alimentation, le poirier s'est toujours empressé de produire de gros fruits à chair fondante; que le navet pour nous faire plaisir, a gonflé sa racine de pulpe savoureuse; que le chou, dans le but de nous être agréable, s'est avisé lui-même d'empiler en tête compacte de belles feuilles blanches. Vous vous figurez que le blé, la carotte, la vigne, la pomme de terre et tant d'autres encore ont, de leur propre gré, toujours travaillé pour l'homme. Il vous semble que la grappe de la vigne est pareille maintenant à celle d'où fut exprimée la première tasse de vin; que le blé, depuis qu'il est sur la terre, n'a pas manqué, tous les ans, de produire une récolte de grain; que la betterave avait, aux premiers jours du monde, la corpulence qui nous la rend précieuse. Vous croyez, enfin, que les plantes alimentaires nous sont venues dans le principe telles que nous les possédons aujourd'hui...

"La plante, telle qu'elle vient naturellement, est pour nous une triste ressource alimentaire; elle n'acquiert de la valeur qu'en passant par les mains de la puissante fée qui a nom *industrie humaine*; sous la baguette de la sublime magicienne, c'est-à-dire par nos soins, par la science, les espèces se modifient jusqu'à devenir méconnaissables."

En admirant un magnifique champ de blé Marquis, le nom d'un savant canadien, du Dr Saunders, des Fermes expérimentales, passera dans sa mémoire. Il voudra relire le bel article: *L'Histoire d'un blé canadien et l'oeuvre de nos céréalistes*, paru dans le Journal d'Agriculture du mois d'octobre 1920, commençant par ces phrases:

"Comme si c'était nécessaire pour se faire reconnaître et se faire mieux apprécier, la science, en nous livrant ses secrets, se révèle parfois d'une puissance qui tient du prodige.

"Dans la petite étude que nous allons faire ici, d'une variété de blé, nous voudrions, une fois de plus, attirer l'attention sur l'extrême complexité de certaines recherches scientifiques et la haute portée pratique qu'elles peuvent avoir dans la pratique agricole.

"C'est, cette année, le dixième anniversaire de la création du blé Marquis.

"Bien que l'on ait fixé cette variété un peu avant cette date, ce ne fut qu'en 1910 qu'elle remporta ses premiers succès. Les producteurs de blé de l'Ouest furent, cette année-là, très vivement intéressés par un certain rapport où un champ de cinq acres de blé Marquis, cultivé à Indian Head, Sask., avait donné un rendemen de 55 minots à l'acre.

"Dès l'automne 1911, M. Seager Wheeler, cultivateur progressif de Rosthern, Sask., remporta le prix de $1,000.00 en or offert par Sir Thos. Saughnessy à l'exposition des produits de ferme, tenue à New-York, pour le meilleur cent livres de blé cultivé sur le continent américain en 1910 ou 1911. Le prix fut donc gagné avec une exhibit de blé Marquis produit à Rosthern, en 1911 et, fait qui rendit sa victoire d'autant plus remarquable, la saison avait été singulièrement contraire à la production d'un blé de haute qualité."

Et le directeur du Journal d'Agriculture met sous nos yeux l'épopée du blé Marquis, que tous les cultivateurs, aujourd'hui, cultivent sur leurs fermes.

Notre visiteur intelligent, en passant à côté d'un champ de pommes de terre, remarque que certains pieds sont attaqués par le champignon qui cause le mildiou, communément appelé *pourriture de la pomme de terre.* Encore là, une pléiade de savants, d'hommes de laboratoires: les Kuhn, les Berkeley, les Millardet, les Prilleux, les Delacroix, les Ward, les Atkinson, etc., se lèvent et parlent: "Nous avons, dans nos laboratoires, découvert que les maladies végétales sont causées par des champignons microscopiques et des bactéries. Nous avons étudié le cycle évolutif de ces organismes et enseigné au monde les moyens de les détruire. Nos recherches, ajoutées à celles de nos amis les entomologistes: les Fabre, les Rily, les Fletcher, les Hewitt, les Comstock, etc., sauvent les récoltes de la destruction, valent aux nations des millions de dollars."

Les physiciens, les ingénieurs, les mécaniciens, dans les instruments aratoires: tracteurs, lieuses, faucheuses, etc., apparaissent à leur tour.

Le visiteur cultivé est maintenant en présence des troupeaux. Que voit-il encore? Toujours de la science. Les Colling, les Bakewell, les Druce, et tous ces créateurs de races qui font notre fortune se présentent à lui.

Ne découvre-t-il pas encore dans l'administration de cette ferme, dans l'agencement des différents facteurs de la production: de la terre, du capital, de la main-d'oeuvre, au-dessus desquels il place l'intelligence, l'application des principes de l'économie rurale, de la science des Warren, des Carver, des Taylor, des Jouzier.

Convaincu plus que jamais de l'importance de la science, de l'importance du facteur intelligence, de la puissance scientifique, notre visiteur quitte cette ferme moderne avec la volonté de porter ce facteur dans tous les coins de sa province, de mettre la science à la portée de tous, de la vulgariser, de l'*accroître par des découvertes nouvelles.*

"C'est à l'intelligence, se dit-il, avec Valois, qu'il faut faire le plus pressant appel. Donnons-lui le rang, l'honneur, les soins, la rémunération qui lui sont nécessaires. Dans notre civilisation qui paraît dominée par les forces matérielles, c'est l'intelligence qui porte partout l'animation. Sans elle, la machine n'est que vile ferraille."

Il entreprend alors de dresser les cadres d'un enseignement agricole pour sa province.

Dans l'enseignement agricole, comme dans tout enseignement, il devrait y avoir une gradation nettement établie:

Un enseignement élémentaire; un enseignement moyen; un enseignement supérieur.

Le Conseil de l'Instruction Publique vient de publier le nouveau programme de l'enseignement primaire. Il propose de limiter l'école primaire proprement dite aux six années des cours élémentaires et modèles de l'ancien programme, puis de créer, à la suite, une école complémentaire qui élargirait les connaissances primaires et donnerait un commencement de spécialisation. Cette école complémentaire ou primaire supérieur remplacerait le cours académique de deux ans de l'ancien programme. L'enseignement primaire comprendrait donc en tout huit années de cours dont six pour l'école primaire-élémentaire et deux pour l'école primaire-complémentaire.

L'enseignement élémentaire de l'agriculture devrait être greffé sur ce programme.

L'école primaire-élémentaire ne peut être un foyer intense de science agricole. Les élèves qui la fréquentent y entrent à l'âge de six ans et en sortent à l'âge de douze ans. Ici, ce n'est pas tant à l'intelligence qu'il faut s'adresser qu'au sentiment. Ce qui importe, à l'école primaire, c'est d'habituer les enfants à observer, à s'intéresser aux choses qui les entourent. L'enseignement de l'agriculture y serait à base d'observation, s'y donnerait sous forme de leçons de choses. Que de moyens à notre disposition, que de choses intéressantes pour les élèves dans la grande nature où ils vivent: plantes, arbres, animaux, oiseaux, insectes, etc.

A l'école primaire-supérieure ou complémentaire, l'agriculture s'enseigne réellement. Le nouveau programme de ces écoles pourvoit à une heure d'enseignement agricole par semaine, ce qui fait pour les deux années environ 480 heures. On y voit figurer la physique, la chimie, la zoologie, la botanique élémentaires, la grande culture, la zootechnie, l'horticulture, l'économie rurale, etc. Cet enseignement devrait être complété par des visites, des enquêtes sur les meilleures fermes de la province. Pourquoi telles fermes payent-elles et telles autres ne payent-elles pas? L'élève ainsi se rendrait compte que l'agriculture est une industrie et que seuls les cultivateurs qui savent agencer intelligemment les différents facteurs de la production y réussissent et prospèrent.

Pour préparer les maîtres à donner cet enseignement, on devrait enseigner l'agriculture dans les écoles normales et organiser, pour eux, laïques et religieux, des cours de vacances. L'agronome du comté prêterait main-forte. On aurait peut-être, dans chaque comté, un directeur de l'enseignement élémentaire de l'agriculture dont le rôle consisterait à donner des cours et à diriger l'enseignement agricole des instituteurs. Une bonne direction générale s'imposerait.

Les garçons qui auraient fréquenté ces écoles auraient acquis le goût des études agricoles et seraient déjà préparés, supposant qu'ils ne pussent poursuivre leurs études plus loin, à être de bons cultivateurs.

Il est certain qu'on ne peut pas s'attendre à ce que les élèves des écoles complémentaires rurales embrassent tous la carrière agricole. Il faut compter avec les aptitudes, la vocation de l'enfant. Quelques-uns de ceux qui ne bornent pas leurs études à l'école complémentaire voudront embrasser la carrière commerciale, d'autres, la carrière industrielle. C'est le devoir du maître de les connaître ceux-là, et de les diriger vers les écoles spéciales de commerce et d'industrie. Ceux qui se destinent à l'agriculture — souhaitons que ce soit le grand nombre — et qui désirent continuer leurs études agricoles prendront la route des écoles moyennes d'agriculture.

Ces écoles seraient pour l'agriculture ce que les écoles techniques sont pour l'industrie. Vous tous, qui ne cessez de nous répéter que nous sommes un peuple agricole, comparez nos écoles d'agriculture à nos écoles techniques, à celle de Montréal et de Québec entre autres, à nos écoles commerciales, et concluez!

L'enseignement qu'on devrait y donner prend une tournure plus scientifique que dans les précédentes. Ceux qui rêvent de former de bons cultivateurs sans enseignement scientifique ont de la limaille de fer dans les yeux.

"Dans ces écoles, écrivait M. A. Gosselin, dans le *Devoir* du 9 mars 1920, on devrait s'appliquer à former d'habiles praticiens. L'enseignement technique agricole devrait y avoir une large part. Pour cela, on devrait avoir l'outillage nécessaire pour faire les applications pratiques. Ainsi, on pourrait initier les élèves aux différents travaux que le cultivateur est appeler à faire sur les fermes d'aujourd'hui."

Une ferme modèle, une ferme bien administrée, une ferme où l'on applique les principes de l'économie rurale, où l'on sait, en regardant dans les livres de la comptabilité, ce qui paye, où l'on peut suivre les mouvements des différents facteurs de la production, devrait être annexée à cette école pratique et donnée en exemple à tous les élèves qui la fréquenteraient.

Les professeurs analyseraient avec leurs élèves quelques fermes de la région et leur enseigneraient pourquoi tlles fermes payent et telles autres ne payent pas. Ce genre d'enseignement est le meilleur qui existe quand il s'agit de former des cultivateurs qui raisonnent leur affaire. L'économie rurale, la science de l'administration de la ferme, voilà un point essentiel que nous cherchons cependant en vain à rencontrer sur certaines fermes déclarés modèles.

L'école de Kemptville, Ontario et celle de Raymond, Alberta, peuvent être données comme exemples d'écoles moyennes ou pratiques.

"Les bâtiments nécessaires pour les élèves qui désirent étudier la pratique agricole à l'école de Kemptville ont été terminés et munis de l'outillage le plus moderne. La construstion de l'école principale et du pavillon de la mécanique agricole a été terminée l'été dernier. Ces deux bâtiments, avec le pavillon du bétail, fournissent d'excellentes commodités pour la conduite d'un cours de deux ans en agriculture. Outre le cours régulier, on y donne des cours abrégés d'industrie animale, d'industrie laitière, de mécanique, etc. Une ferme modèle y est annexée."

Nos écoles pratiques régionales — même celle que l'on projette d'établir à Rimouski — devraient ressembler à celle de Kemptville. Elles seraient alimentées par les élèves des écoles complémentaires qui désirent approfondir les sciences agricoles générales ou étudier une spécialité.

"L'enseignement agricole, écrivait le professeur Nagant, dans la Revue Trimestrielle du mois de novembre 1917, comme la sève ou le sang dans un organisme doit pouvoir atteindre chacun des innombrables chefs d'exploitations éparpillés par tout le pays comme les cellules dans l'organisme. Il doit donc partir d'un organe central, comme le sang du coeur, puis, par une suite de modificaitons et d'adaptation, en cours de route, être diffusé à travers les masses profondes des exploitants du sol, par tout le réseau des canalisations secondaires, qui en mettra les principes à la portée de tous.

"Cet organe central, c'est l'ensegnement agricole supérieur, *source du progrès agricole d'un pays.*

"De sa force, de son organisation et des moyens dont il dispose, dépendent aussi l'impulsion et les bonnes méthodes de l'enseignement vulgarisé et pratique, qui en découle, tout comme la fécondité de l'Egypte est sous la dépendance de la crue du Nil, qui lui distribue ses eaux bienfaisantes par mille canaux d'irrigation.

"Or, on rencontre encore des personnes qui ignorent ou méconnaissent la nécessité des hautes études en agriculture."

Comment, sans école supérieure, pourrait-on alimenter, nourrir les écoles élémentaires, les écoles moyennes d'agriculture, tenir sans cesse en mouvement le mécanisme de la vulgarisation, dont les agronomes de district, les experts du Ministère de l'Agriculture, les journalistes agricoles, etc., forment les rouages? Comment, sans organe central, sans coeur, maintiendrons-nous la vie dans notre système d'enseignement agricole?

Ensuite, est-ce tout d'enseigner la science faite? Ne devons-nous pas l'accroître par des découvertes nouvelles? N'est-ce pas là la fin véritable de l'enseignement supérieur?

"C'est par la puissance scientifique, écrit M. Antonio Perrault, qu'un peuple perfectionne ses méthodes de travail et augmente ses richesses, de quelque nature qu'elles soient. Et cette puissance scientifique où mieux qu'à l'Université peut-elle se constituer? L'Université doit non seulement contribuer au progrès par les générations de jeunes hommes qu'elle fournit à la société, mais aussi en permettant à quelques savants de faire avancer la science par leurs recherches, stimuler par leurs découvertes l'essor moral, intellectuel et industriel du peuple."

Voilà, tels qu'exposée par notre homme, les cadres d'un enseignement agricole que nous soumettons à la considération des lecteurs de la *Revue Agronmique.*

FIRMIN LETOURNEAU.

LA CONVENTION GENERALE.

La Société des Agronomes Canadiens tiendra sa première convention régulière, à Winnipeg, les 15, 16 et 17 juin prochain. L'élément canadien français y sera représenté par MM. A.-T. Charron, directeur de l'Ecole de Laiterie de St-Hyacinthe, N. Ponton, rédacteur du Bulletin des Agriculteurs, Jules Simard, du Service fédéral des semences, président de la Section de Québec, Georges Bouchard, professeur à l'Ecole d'Agriculture de Ste-Anne de la Pocatière, L.-P. Roy, chef du Service de la grande culture, secrétaire de la Section de Québec, A. Létourneau, directeur du Journal d'Agriculture et quelques autres.

Cette convention, ainsi qu'on peut en juger par le programme que nous avons publié dans le numéro du mois d'avril, s'appliquera à résoudre une foule de problèmes agricoles de la plus haute importance pour le pays.

La Solution du Problème de l'Azote

Bilan de l'azote combiné dans le sol.

Par H.-M. NAGANT, I.A., I.F., professeur à l'Institut Agricole d'Oka.

(Suite de la page 185 du numéro d'avril)

Nous avons dit qu'une fois arraché à l'atmosphère, ce grand détenteur mais avare banquier d'azote improductif, l'élément avait une tendance à rester en circulation dans le règne organique, ou tout au moins à former dans les débris organiques, végétaux ou animaux, accumulés à la surface du globe des réserves de composés azotés, susceptibles d'être repris tôt ou tard par la végétation toujours renaissante, pour recommencer le cycle des transformations biologiques.

Les exemples les plus frappants de ces réserves latentes d'azote combiné, momentanément immobiliser, nous sont données par les accumulations d'humus dans les tourbières, les prodigieux gisements de nitrate de soude au Chili, les dépôts de guano au Pérou, tandis que les composés azotés de l'humus des bois et des prairies reprennent petit à petit de l'activité dans de nouvelles élaborations. Mais il y a à tenir compte de causes de déperdition affectant le stock des composés de l'azote. Les principaux facteurs de déperdition sont:

1.—*La destruction d'une partie des composés azotés* par certains ferments qui libèrent l'azote et le font retourner à l'atmosphère. Tels sont par exemple les *microbes dénitrificateurs* qui s'attaquent aux nitrates et les réduisent en azote libre.

2.—*Le lavage des nitrates*, sels très solubles et non absorbés dans le sol, par les eaux d'infiltration, qui les entraînent dans les profondeurs du sous-sol, hors de portée des végétaux et en milieu réducteur. Dans la nature, livrée à la végétation spontanée, les apports, faits au règne organique, d'azote combiné par les bactéries fixatrices et les phénomènes électriques l'emportent sur les causes de déperdition ou de rétrogradation de l'azote. Si chaque année on pouvait dresser l'inventaire du capital roulant d'azote physiologique, la clôture s'en ferait donc par un surplus favorable. Il en résulte que toutes autres conditions, température, humidité, etc., restant égales, la végétation sur notre globe doit avoir une tendance à devenir de plus en plus luxuriantes, grâce à l'accroissement des disponibilités en azote combiné. Mais les choses se sont bien modifiées, à mesure que des multitudes humaines de plus en plus compactes ont recouvert la surface de notre planète; à mesure que l'agriculture s'est emparée progressivement de toutes les terres cultivables, et que la civilisation fait naître les immenses agglomérations urbaines. L'équilibre favorable se déplace rapidement, car l'homme est un grand gaspilleur de l'épargne d'azote combiné formée dans le cours des millions d'annés de végétation spontanée, au sein des forêts, dans les étendues de prairies primitives et de steppes, et même de celle qui se trouve enfouie dans les couches géologiques profondes.

Ceci s'explique tout seul; d'abord le travail continuel du sol, labours, hersages, binages, a pour effet de consommer rapidement l'humus y laissé par la végétation primitive, grâce à l'oxydation intensive que favorise l'aération. Le sol cultivé pâlit et devient de moins en moins fertile, à mesure qu'avec l'humus disparaissent les réserves d'azote combiné. Les immenses quantités de céréales prélevées chaque année sur les surfaces cultivées drainent vers les grands centres populeux des millions de tonnes d'azote combiné qui s'en va à l'égout, puis à la mer, diminuant d'autant le capital roulant d'azote.

Aussi, au lieu de s'accroître, comme jadis, celui-ci se trouve chaque année plus fortement entamé et le pouvoir de végétation baisse.

Le déficit s'affirme toujours davantage et nous conduit donc, plus ou moins vite, mais sûrement à la faillite de la production agricole, faute de disponibilités en azote. D'ailleurs les indices menaçants se manifestent depuis des années déjà, sur le vieux continent européen plus particulièrement.

Il y a 50 ou 60 ans que le cultivateur d'Europe, ayant dépensé, sans pouvoir les régénérer, toutes ses disponibilités immédiates en azote physiologique, s'adressa à ces réserves latentes, dont nous avons déjà parlé, qui par un singulier concours de circonstances se sont condensées en quelques endroits du globe. Depuis lors, les dépôts de *guanos Péruvien* on été épuisés, les champs de nitrate de soude du Chili se consomment rapidement; la limite de temps assignée à leur extinction ne dépasse par la cinquantaine d'années, suivant les prévisions les plus optimistes.

Reste l'ammoniaque de la houille, dont la récupération se généralise de plus en plus lors de la distillation. Tant qu'on extraira du charbon, le sulfate d'ammoniaque constituera, il est vrai, un appoint précieux pour l'agriculture, mais la quantité disponible chaque année restera forcément limitée à la fabrication du coke.

Est-il chimérique de prévoir le temps où l'agriculture mondiale sera à peu près dans la situation de cet industriel qui n'a pas pris le souci de se créer des disponibilités renouvelables à brève échéance? La fabrication d'une partie de la saison a absorbé tout son capital roulant; de nouvelles commandes plus nombreuses et pressantes l'assaillent, mais il ne peut plus les satisfaire; ses machines sont partiellement arrêtées ou tournent à vide alors qu'elles devraient fournir à pleine capacité; le stock de matière première est épuisé, pas de disponibilités pour en assurer le renouvellement en temps utile, impossible d'exécuter les commandes d'une clientèle qui ne peut attendre.

Non, et ce n'est pas d'aujourd'hui que cette préoccupation hante l'esprit des économistes et des agronomes soucieux du sort de leurs arrières-petits fils. Ainsi en 1898 Sir William Crookes jeta une note alarmante en prévision de l'impossibilité ou se trouverait l'Europe et l'Amérique de nourrir leurs populations toujours grandissantes, vers la fin du siècle présent; ses calculs étaient basés principalement sur la limitation de la surface propre à la culture des céréales. Selon son estimation le nombre des mangeurs de pain atteignait le chiffre de 516,000,000, en 1889; à cette même époque la surface cultivée en céréales était de 167,000,000 d'acres, et il ne restait que 100,000,000 d'acres, propres à cette culture, de disponibles. Toujours d'après ces chiffres la consommation annuelle de blé, par tête, aurait été de 4.6 boisseaux et le rendement moyen par acre de 12.8 boisseaux. Sur ces données il calcula que les champs de blé devraient pouvoir couvrir une surface de 202,000,000 acres en 1941 pour satisfaire les exigences alimentaires d'une population atteignant alors 819,000,000 de mangeurs de pain. Le rendement moyen des

céréales par acre, ainsi qu'en témoignent les statistiques des pays à culture extensive, diminuent constamment, or il faudrait pouvoir l'augmenter!

L'azote dans les explosifs.

Pour comble d'infortune, les explosifs, qui, durant cinq ans, ont vomi la mort et la destruction à travers toute l'Europe, viennent encore disputer à l'agriculture les réserves d'azote combiné, capables d'intensifier la production actuelle, de retarder l'avènement de la famine universelle.

Depuis notre vieillle poudre noire, en passant par la dynamite, l'acide picrique, le nitrotoluène, etc., jusqu'aux produits les plus diversifiés de la pyrotechnie moderne, presque tous sont à base nitrée, quoique l'azote ne joue pas un rôle actif dans la réaction chimique violente que constitue tout explosif. L'azote n'est que le lien fragile servant à condenser sous un petit volume des masses d'oxygène, lesquelles brusquement libérées par l'effet d'une étincelle ou d'un choc, des insta-

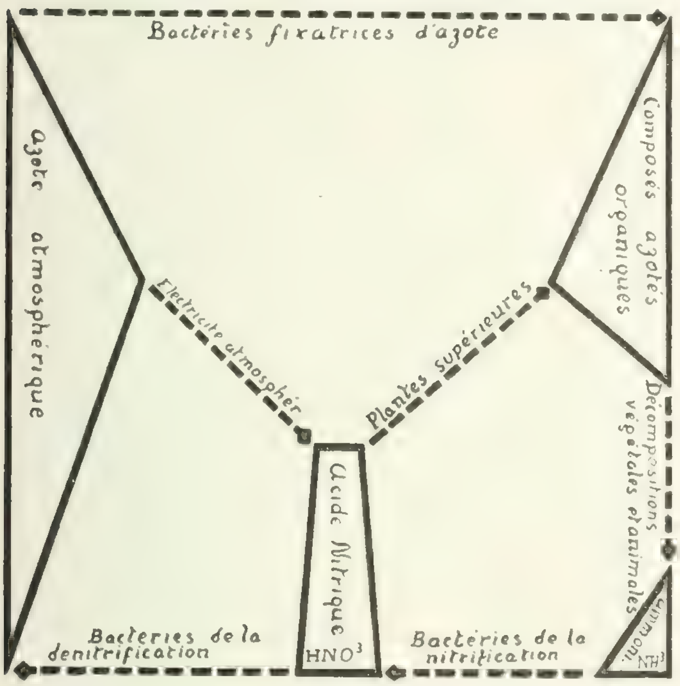


Diagramme permettant de suivre d'un coup d'oeil le cycle des transformations de l'azote passant de l'atmosphère dans le règne organique.

bles entraves d'affinités qui les retiennent au premier élément, se dégagent tumutueusement pour étreindre avec frénésie les atomes du combustible quelconque placé en contact avec lui, déterminant la formation de masses gazeuses à expansion rapide comme l'éclair, irrésistibles dans leur force de projection et destructive de tout ce qui les environne.

A peu près toute l'extraction du nitrate de soude du Chili, qui a atteint 3,000,000 de tonnes annuellement, a durant la dernière guerre fourni son énergie aux explosif qui font sauter des collines, ceusent des cratères grands comme ceux des volcans, lancent des obus d'une tonne à des distances dépassant 75 milles et portant une charge capable de réduire en miettes une forteresse de l'ancien temps.

Mais l'Allemagne, dira-t-on, d'où tira-t-elle ces produits azotés? D'où eut-elle le nitrate indispensable, non seulement pour répondre du tac au tac au bombardement intensif des alliés, mais encore pour couvrir parfois le tonnerre de leur artillerie et les submerger sous une trombe de projectiles, nécessitant une véritable débauche d'explosifs?

Les alliés, évidemment, firent bonne garde dès l'ouverture des hostilités, empêchant tout bateau transportant du salpètre chilien de pénétrer directement ou indirectement dans un fort teuton. Réduites au nitrate naturel, dont les puissances du centre pouvaient posséder peut-être un stock respectable, en prévision de plusieurs mois d'hostilités, la fabrication des explosifs, après une prodigalité de dépenses en munitions que nul n'eût pu prévoir, eût néanmoins été arrêtée bien vite. Les premiers mois de guerre passés, l'Allemagne eût eu beau alligner des multitudes de "*dicke-Berthas*" à la gueule menaçante, privés de leur effroyable aliment, ces monstres forcément devenus muets, eussent été dès lors, une proie facile pour les vaillants bataillons alliés chargeant à la bayonnette. Les foudres n'accompagnant plus les hordes germaniques, celles-ci n'eussent pas tardé à abandonner leurs tranchées pour reculer en désordre jusqu'au fond de leur pays, poursuivies l'épée dans les reins par les nations qu'elles voulaient dépouiller et asservir. Or on voit que ce n'est pas le manque d'explosifs qui finalement entraîna la déconfiture.

Le besoin d'explosifs fait surgir une formidable industrie de produits azotés, en Allemagne.

Aussi la seule explication que l'on puisse donner de cette énigme pyrotechnique est celle-ci:

Depuis le début de la guerre, l'Allemagne a poussé la conquête de l'azote atmosphérique dans des limites inattendues; elles a réussi à appliquer sur une vaste échelle certains procédés industriels de synthèse, pour plusieurs composés azotés, que, de plus, elle est capable de convertir en produits nitrés. La fabrication de certains de ces composés, la *cyananide de calcium, $CaCN^2$*, ainsi que l'acide nitrique, en Norvège, commençaient déjà à acquérir quelque importance, une ou deux années avant la guerre, il est vrai, mais si la nouvelle industrie allemande de l'azote a, depuis, fortement poussé la fabrication de la cyanamide, il semble bien que la part du lien, parmi les produits de synthèse, revienne à l'ammoniaque, préparé par le fameux procédé Haber, dont la mise en pratique était encore dans l'enfance en 1914. Disons tout de suite, afin d'indiquer par un simple chiffre les pas de géants faits par une industrie absolument nouvelle, née d'hier, que, d'après les rapport consulaires américains, mentionnés dans le bulletin de Janvier 1918 de "Revue de l'Institut International d'Agriculture de Rome", qui fait le compte rendu semestriel du mouvement international des produits chimiques utiles à l'agriculture, on évalue à 500,000 tonnes, le sulfate d'ammoniaque obtenu pendant l'exercice 1917 par le procédé synthétique, Haber. Ceci seul représente déjà la production mondiale de sulfate d'ammoniaque récupéré des produits de distillation de la houille, en l'an 1900.

Enfin le rendement des fabriques allemandes de cyanamide de calcium, serait, d'après les chiffres moyens destimation, également de 500,000 tonnes pour l'année 1918; ce qui ferait, en un an, un million de tonnes de produits azotés synthétiques pour le seul empire germanique, sans compter, éventuellement, l'acide nitrique obtenu directement.

Il n'y avait donc pas lieu de s'étonner que les communiqués de guerre des alliés mentionnaient si fréquemment des raids d'aéroplanes, exécutés par leurs escadrilles, contre les grands établissements "*Badische Soda ûnd Anilin Fabriken*", à Lulwigshafen, où étaient concentrées surtout les installations pour la fabrication de

l'ammoniaque synthétique, dont cette puissante firme de colorants s'est fait une spécialité, après avoir résolu tous les détails techniques, dans la mise en pratique du procédé Haber.

D'autre part si l'ammoniaque n'est pas utilisable, comme tel en pyrotechnie, ainsi que nous l'avons déjà dit, les allemands savent le transformer en acide nitrique. Leur plus célèbre chimiste actuel, le Docteur Ostwald, de Leipzig, a établi, sur une base industrielle, un procédé d'oxydation de l'ammoniaque, fournissant un mélange d'acide nitreux et d'acide nitrique, dont le principe était d'ailleurs déjà connu et pratiqué depuis longtemps dans des expériences de laboratoire; il s'agit de l'oxydation de l'ammoniaque en présence du platine chauffé au rouge ou de certains autres agents catalytiques.

A défaut d'une étude un peu substantielle, que ne comporte pas les limites d'un article de revue, car à l'heure actuelle cela demanderait tout un volume, il nous reste du moins à donner un bref aperçu de la génèse de l'industrie des principaux composés azotés tirés de l'air, du principe de leur fabrication, de l'économie de celle-ci, et quelques statistiques montrant l'importancec grandissante qu'ils acquèrent à côté des composés azotés naturels, menacés d'épuisement prochain, ou ceux dont le rendement restera toujours inférieur aux besoins croissants.

C'est par là que nous terminerons, mais au préalable, pour faire ressortir davantage la grandeur de la conquête réalisée sur l'atmosphère, durant ces dernières années, il sera peut-être utile de rappeler en quelques mots en quoi consistent ces:

Réserves d'azote combiné naturel, exploitées jusqu'ici.

A part l'azote organique contenu dans l'humus des terrains encore vierges, devenant d'ailleurs chaque jour plus restreints, dont l'agriculture peut encore prendre possession, il reste au cultivateur, dont le vieux fond s'épuise ou qui veut intensifer ses rendements, les grandes sommes suivantes d'azote combiné naturel, pour alimenter son industrie:

1.—*Le nitrate de soude du Chili.*

2. *L'ammoniaque récupré de la houille et de quelques autres matières d'origine organique.*

Nous ne ferons pas mention de sources très accessoires ou déjà épuisées, telles que les guanos, le salpêtre ordinaire, le sang et autres déchets azotés provenant des abattoirs.

Le nitrate de soude ou salpêtre du Chili.

Les gisements de nitrate de soude sont situés au Chili, entre le 15me et le 26me degré de latitude Sud, sur une longue bande de terrain formant une sorte de plateau étroit entre la chaîne des montagnes côtières bordant l'Océan Pacifique et la ligne beaucoup plus élevée de la Cordillère des Andes.

Cette zône longue d'environ 800 kilomètres constitue une véritable désert brûlant où il ne pleut jamais. A une très faible pofondeur, variant de quelques pouces à quelques pieds, on trouve, reposant sur des roches quaternaires, la couche de nitrate brut appelé "*caliche*".

Le nitrate commercial, d'une pureté moyenne de 95 pour cent de $NaNO^3$, dosant de 15 à 15.5 pour cent d'azote, est obtenu par le raffinage de la "caliche", dont la composition est très variable.

A part des matières terreuses le minerai brut est formé d'un mélange de plusieurs sels, chlorure de sodium, sulfate de sodium, sulfate de magnésium, sulfate de calcium, iodate de sodium, etc., et renferme de 15 à 65 pour cent de $NaNO^3$.

L'épaisseur de la couche de caliche recouvrant les champs nitratiers est aussi très inégale; pouvant varier de quelques pouces à 18 pieds, le plus souvent elle oscille entre un et trois pieds.

On sait que le raffinage s'obtient en épuisant par de l'eau chaude la caliche; le $NaNO^3$ est alors séparé de la solution saturée des différents sels solubles, en laissant refroidir celle-ci dans de vastes bassins de cristallisation.

Dans quelques usines les eaux mères sont traitées pour en extraire l'iode qui est ainsi un produit accessoire de l'industrie nitratière.

La formation de ces vastes dépôts de salpêtre sodique est encore un mystère pour la géologie; car si leur origine organique semble ne pas faire de doute on en est encore réduit à des hypothèses quant à la nature des matières organiques dont la décomposition a fourni d'aussi grands amas d'azote nitrique. La théorie la plus généralement acceptée est celle de Nollner, attribuant à des végétaux marins l'origine du salpêtre du Chili. D'après Nollner, le plateau nitratier actuel formait autre fois un fond marin; par suite d'un soulèvement lent et progressif d'énormes quantités d'aigues se développèrent sur ce haut fond, encore augmentées, durant les saisons de tempêtes, par de grandes quantités de végétaux marins apportées par les vagues déferlant sur l'étroite ligne côtière. Les grandes masses végétales ainsi accumulées se décomposèrent dans les conditions les plus favorables à la nitrification et le nitrate formé resta sur place en l'absence de pluies qui auraient pu le dissoudre.

Quoiqu'il en soit, ces dépôts puissants de salpêtre ne se regénèrent pas, tandis que leur exploitation s'intensifie d'année en année. De 25,000 tonnes de nitrate raffiné, en 1850, l'exportation du Chili passa successivement à 150,000 tonnes en 1870, 1,000,000 en 1890, 1,400,000 en 1900, pour atteindre les trois millions de tonnes ces dernières années. Sachant qu'à l'heure actuelle le prix de la tonne de nitrate de soude s'établit aux environs des 75 dollars à New-York, on se rendra facilement compte de la source de richesse que constitue son exploitation pour le Chili.

Avant la guerre 80 pour cent de l'importation européenne, largement prédominante alors, passait à l'agriculture. Aux Etats-Unis la proportion absorbée par diverses industries a toujours dépassé la consommation agricole du nitrate et depuis la guerre l'écart s'est naturellement fortement accentué; ainsi pour l'année 1917 on estime à 600,000 tonnes la quantité de salpêtre sodique que ce seul pays a fait entrer dans la fabrication des explosifs.

Autre chiffre suggestif, on calcule que durant la période de 31 ans écoulée entre 1879 et 1910, le monde a payé au Chili un tribut de 425,000,000 de dollars, pour ses besoins en nitrate.

Epuisement des dépôts de salpêtré au Chili.

D'après Semper et Michels, qui firent une étude approfondie de la question nitratière, tenant compte de l'accroissement constant des exportations, il y a lieu de prévoir un épuisement complet des champs nitratiers dès l'année 1947. L'Association de propagande pour le nitrate du Chili estimait, à la fin de 1910, la quantité totale de salpêtre encore susceptible d'être extraite, à 246,000,000 de tonnes. D'autre part le professeur Grandeau, de l'Institut Agronomique de Paris, autorité reconnue en matière d'engrais, fixait vers la même épo-

que, le chiffre de 220,000,000 de tonnes, peu divergent du précédent, comme minimum certain du nitrate encore disponible. Avec une augmentation annuelle moyenne de consommation, s'élevant à 50,000 tonnes, il calculait une extraction de 5,000,000 de tonnes en 1950, ce qui aurait laissé encore 17 années à cette date avant d'attendre l'épuisement complet des précieux dépôts. Depuis lors l'augmentation moyenne annuelle d'extraction a sensiblement dépassé l'estimation de Grandeau, on ne peut donc être taxé de pessimisme en présumant, qu'en effet, d'ici à une cinquantaine d'années, le Chili sera dépouillé de sa principale richesse et le monde de sa plus grande source actuelle d'azote complémentaire.

Sulfate d'ammoniaque.

Il est vrai qu'à mesure que la demande de composés azotés s'est faite plus pressante, de la part de l'agriculture, le sulfate d'ammoniaque est venu à la rescoursse du salpêtre chilien, et sa production, qui depuis quelques années tend à rattrapper d'importance le dernier, pour le nombre de tonnes d'azote fourni, est encore susceptible d'un développement considérable.

La source principale de récupération industrielle de l'ammoniaque est la houille; accessoirement il y aurait encore à mentionner la tourbe, les schistes bitumineux, les matières de vidange, etc., dont la distillation en fournit ou peut fournir une certaine quantité.

La houille, à cause de son origine végétale, contient de 1 à 1.5 pour cent d'azote, dont une partie se dégage, sous forme d'ammoniaque, lors de la calcination en vase clos. Autrefois il n'y avait guère que les usines à gaz d'éclairage qui récupérassent l'ammoniaque retenu dans les eaux d'épuration du gaz de ville, à l'état libre ou de sels ammoniacaux divers, pour le fixer sous forme de sulfate d'ammoniaque.

Dans la fabrication du coke pour usages métallurgiques les produits voltails étaient ou bien totalement perdus dans l'atmosphère, ou simplement brûlés dans les foyers servant au chauffage des cornues de distillation, sans souci de récupération des divers sous-produits formant la base d'une des plus florissantes industries de l'Allemagne.

Ce fut surtout la valeur grandissante du sulfate d'ammoniaque qui incita, depuis un certain nombre d'années déjà, à remplacer progressivement les fours à coke primitifs, par des fours à récupération, en Europe. Les Etats-Unis, toujours grands gaspilleurs de matière brute, malgré leur avance pour le perfectionnement du machinisme, ont conservé beaucoup plus longtemps leurs fours à coke, en forme de ruche d'abeillles, et ce n'est que dans les toutes dernières années que le système de récupération s'y substitue avec activité, réalisant des progès difficiles à suivre, dans la production du sulfate d'ammoniaque, dont le besoin a augmenté par la guerre.

Les statistiques suivantes pourront être d'intérêt, parce qu'elles démontrent bien l'importance rapidement acquise par le sulfate d'ammoniaque. En 1900 la production mondiale ne dépassait pas les 500,000 tonnes, partagée principalement entre deux producteurs, le Royaume-æni et l'Allemagne; en 1910 elle montait à 1,100,000 tonnes, cependant que la part des Etats-Unis malgré un progrès marquant sur les années précédentes, n'atteignit encore que 115,000 tonnes. A partir de 1913 on ne possède plus de statistiques complètes, mais, outre que les rendements du sulfate d'ammoniaque ont progressé, depuis, en Allemagne et en Angleterre, le bulletin du mois de Janvier 1918, publié par l'Institut International d'Agriculture de Rome prévoyait un chiffre de 400,000 tonnes pour la production américaine seule, durant l'exercice 1917. D'autre part monsieur Frédérick W. Bown du "Bureau of soils" de Washington, cité par l'*American Fertilizer* du 28 mai 1918, estimait que si toute la houillle actuellement convertie en coke, aux Etats-Unis, l'était dans des fours à récupération, ce pays disposerait chez lui de 900,000 tonnes de sulfate d'ammoniaque, alors que l'année 1910 n'avait fourni que 325,000 tonnes.

Malgré ces perspectives plus encourageantes ,ouvertes depuis quelques années, par la possibilité d'une récupération toujours plus active de l'azote ammoniacal dégagé par la distillation des houilles, elles ne pouvaient dissiper les appréhensions qu'éveillait la disparition assez prochaine du nitrate de soude, coincidant avec des besoins toujours croissants de composés azotés. Le problème de l'azote restait à résoudre.

Deux voies s'offraient aux recherches des nombreux cerveaux travaillant à une solution éminemment intéressante.

1.—*La restauration du capital "azote de circulation", par voie biologique.*

2.—*La synthèse de produits azotés utiles à l'agriculture, par des méthodes physico-chimique.*

Depuis les découvertes de Hellriegel et Wilfarth, sur le mode spécial d'emmagasinage d'azote combiné, par les plantes de la famille des papillonnacées ou légumineuses, l'activité des agronomes du monde entier s'exerce dans la 1re voie, lorsqu'ils recommandent aux cultivateurs d'introduire à intervalles rapprochées, dans leur rotation, la culture des plantes légumineuses et principalement le trêfle, dont une emblavure peut ramener au sol une centaine de livres d'azote extrait de l'air et fixé à l'état de combinaisons, par les bactéries qui envahissent les racines de ces plantes.

Dans ces dernières années, se basant sur les découvertes, déjà mentionnées, de Berthelot, Beyrinck, etc.; le professeur Bottomley de Kings College, en Angleterre a préconisé une méthode plus directe, de fixation biologique de l'azote libre, au moyen de la *tourbe bactérisée* ou *humogène*, qui fit quelque bruit dans le monde agricole. Le principe, bien facile à saisir, de cette méthode est le suivant:

On prend de la tourbe qu'on fait fermenter sous l'influence des bactéries ordinaires présidant à la transformation des matières organiques en terreau ou humus. Lorsque la transformation en matière humique est à point, le tout est stérilisé par la chaleur. Ce milieu stérilisé, mais très propice à la culture des microbes est ensuite ensemencé au moyen de bactéries spécifiques jouissant du pouvoir de capter l'azote atmosphérique, telles que les *azoto-bacter;* celles-ci s'y développent abondamment, et, grâce à l'énergie empruntée à l'oxydation des matires hydrocarbonées de la tourbe, elles enrichissent celle-ci en composés azotés. La tourbe bactérisée devient donc ainsi par enrichissement progressif au moyen de cultures microbiennes artificielles, un engrais azoté.

Si au point de vue scientifique le professeur Bottomley a obtenu des résultats intéressants avec son humogène, que d'aucuns annonçaient déjà devoir révolutionner les méthodes de fertilisants, du côté économique et pratique ils sont encore nuls, puisque tous les essais dans les stations expérimentales, en Europe et en Amérique ont démontré que le jeu n'en valait pas la chandelle. Nous avons néanmoins voulu mentionner la chose, attendu qu'elle constitue une indication pour des recherches qui peuvent être plus fructueuses dans l'avenir.

(A suivre)

L'Agriculture dans le Comté d'Yamaska

EUGENE BOIVIN, Agronome de district.

Avant de dire ce qu'est l'agriculture dans le comté d'Yamaska, il conviendrait peut-être de donner un aperçu général de la situation du comté et de la nature des terrains y compris.

Le comté d'Yamaska est situé à quelque 60 milles à l'est de Montréal sur le littoral sud du fleuve St. Laurent ou plus exactement sur les bords du lac St-Pierre. Deux larges rivières traversent le comté dans la direction sud-nord: la rivière St-François dont les pentes sablonneuses sont plutôt abruptes à mesure que l'on s'approche de son embouchure; la rivière Yamaska, au lit d'argile moins profond que celui de la première.

La surface du comté est remarquablement plane dans toute son étendue, ce qui rend un peu difficile l'égoûtement des terres au printemps, et recule ainsi de plusieurs jours la date des semailles.

La nature n'a pas été ingrate sous le rapport de la fertilité des terres de ce comté. A part les deux rives est et ouest du St-François qui sont un peu trop sablonneuses, en certains endroits toutes les terres du comté ont un sol arable et un sous-sol ou d'argile ou de terre franche. On y remarque aussi des terrains d'alluvion, principalement ceux avoisinant le lac St-Pierre.

EUGENE BOIVIN.

Les communications par voies ferrées sont relativement faciles: elles sont établies, d'une part, par le Québec, Montréal and Southern qui relie le comté à Nicolet, Sorel, St-Hyacinthe et Montreal; d'autre part par le Pacifique Canadien qui se dirige dans la direction de Farnham, et fait à Ste-Rosalie la correspondance avec les autres compagnies de chemins de fer du Canada.

De ces brèves considérations, il faudrait peut-être conclure que le comté d'Yamaska, par la fertilité de ses terres planes, son site géographique, son accès facile aux marchés des villes, verrait son agriculture très avancée, beaucoup plus même que plusieurs autres comtés de la Province. In n'en est pas ainsi. La cause serait la suivante: la culture du foin, en vue d'en faire un commerce exclusif, a été fort pratiqué, on en a même abusé.

Depuis langtemps, en effet, un grand nombre de yamaskutains cultive le foin, pour le commerce à l'étranger; les terres étant bonnes, l'on semblait ignorer que c'est une culture fort épuisante pour le sol. Comme le dit le proverbe: "Le temps a raison de tout", nombreux sont les cultivateurs qui, aujourd'hui, réalisent la diminution de rendement des terres à foin, aussi bien que la qualité de ce dernier. De plus, les hauts prix des beurres et fromages, obtenus sur les marchés depuis 1914, ont favorisé un changement radical du système de culture, et dès lors, l'industrie laitière a pris un développement presque vertigineux, à tel point qu'elle peut être actuellement considérée comme étant la première industrie du cultivateur.

Cette industrie n'est pas encore parfaite, loin de là, elle est susceptible de grande amélioration. L'agronome se trouve là en regard d'un vaste champ d'action. Son premier travail à cet effet, a été de mener une campagne en faveur: 1o. de l'emploi de taureaux reproducteurs de race pure, et surtout, appartenant à des familles dont le record de reproduction annuel peut être connu; 2o. d'une sélection judicieuse des sujets d'élevage, possible uniquement en autant que le contrôle laitier sera bien fait et suivi intelligemment; 3o. d'une alimentation saine et propre à la production du lait; 4o. d'étables bien éclairées, bien ventillées et suffisamment commodes pour la distribution des fourrages et la traite des vaches.

Les moyens employés pour l'émélioration de ces quatre facteurs importants de l'industrie laitière sont: les organisations de divers concours se rattachant directement à cette industrie même. Ces concours sont, d'ordinaire, tenus sous les auspices du cercle agricole de la paroisse, parfois de la société d'agriculture du comté. Ils comprennent différentes cultures, spécialement celles des légumes et légumineuses, comme par exemple, la production de la graine de trèfle. En 1918, il y avait pour tout le comté une batteuse à trèfle qui décortiquait annuellement de 2,000 à 5,000 livres de graine de trèfle. Actuellement il y en a neuf en opération dont l'une a battu l'année dernière, au-delà de 20,000 livres de graine de trèfle. Les cultivateurs s'adonnent à cette culture avec autant plus de facilité et d'intérêt qu'ils y voient de grands avantages économiques et pour le maintien de la fertilité de leur sol, et pour l'obtention d'un fourrage propre au troupeau laitier.

Ce changement de culture favorise l'extension des cultures sarclées, des céréales, de ce chef, fait augmenter les travaux de la ferme disproportionnellement à la main-d'oeuvre agricole disponible, et amène peu à peu des modifications dans l'outillage de la ferme. A la faveur également de la superficie plane des terres du comté, la motoculture semble vouloir se généraliser de plus en plus. Il y a dans le comté près de 40 tracteurs représentant les différentes marques du commerce. Les cultivateurs propriétaires de tracteur se déclarent tous en faveur de son emploi, sur une ferme d'étendue convenable, tant par la rapidité avec laquelle il permet d'effectuer les travaux culturaux que par l'économie de main-d'oeuvre et de bêtes de somme qu'il préconise en tout temps de l'année.

Il serait incomplet de passer entièrement sous silence les différentes associations agricoles en fonctionnement dans le comté, puisque c'est d'elles-mêmes que l'agriculture reçoit sa première impulsion. C'est ainsi par leur intermédiaire qu'il devient le plus possible à l'agronome d'atteindre à la fois un très grand nombre de cultivateurs. C'est pourquoi, le travail de ce dernier s'étend principalement à la direction, à la surveillance qu'il exerce envers les sociétés de comté, de paroisse, de syndicat d'élevage, etc., en les incitant à acheter des animaux pur sang au profit des membres, en leur faisant ouvrir des concours sur toute branche quelconque de l'agriculture, en un mot en leur faisant tracer la route du progrès agricole.

Il existe depuis deux ans une association avicole de comté qui a son aviseur technique, et qui a tenu sa deuxième exposition avicole en décembre dernier. Cette association a pour mission de grouper les éleveurs de volailles en vue d'adopter les moyens reconnus pratiques d'exploiter économiquement la basse-cour de la ferme. Elle accuse déjà de réels progrès en ce qui regarde la construction de poulaillers modernes et l'augmentation de troupeaux de volailles de race pure.

L'agriculture féminine n'est pas plus négligée que l'aviculture. Quatre cercles de fermières ont pris naissance en 1919 et 1920, et comptent approximativement 250 femmes et jeunes filles. Ces cercles se sont groupés ensemble pour tenir leur permière exposition annuelle en septembre dernier, et ont obtenu de la société d'agriculture du comté une somme d'argent joliment respectable, devant être distribuée en prix aux concurrentes. Dans le cours de l'année des concours sont organisés sous les auspices des fermières: concours de jardinage, de cuisine, de confection de vêtements de laine et de toile du pays, de raccommodage, de tous les travaux qui intéressent la bonne ménagère.

L'on me permettra de terminer ce court travail en mentionnant qu'il n'y a aucune industrie manufacturière dans le comté d'Yamaska, mais qu'il existe une industrie domestique fort appréciée de la majorité des habitants, puisqu'elle leur rapporte un bénéfice global de 300,000 à 500,000 dollars, par année. C'est la confection des paniers de foin d'odeur. Cette industrie a été implantée dans le comté par la tribut des sauvages, les Abénakis, venus se fixer, il y a quelque 60 ans dans la paroisse de St-François-du-Lac. Les canadiens ont appris à leur école la manière de confectionner de jolis paniers de fantaisie, que l'on commerce principalement dans la République américaine voisine. On emploie à cette industrie toute la main-d'oeuvre féminine de la maison, et parfois les hommes sont heureux de s'y livrer pendant les longues soirées d'hiver et les jours d'ouvrage rare. Les vieillards contribuent de leur part à activer cette industrie domestique, qui, comme on le voit, est un précieux complément de l'agriculture pour la population entière du comté.

L'AGRICULTURE MODERNE.

Le temps est passé de l'agriculture indolente et résignée. Le vieux proverbe "tant vaut l'homme, tant vaut la terre" devient chaque jour plus vrai, à condition qu'on entende bien par là l'homme armé des capitaux qu'il faut avoir pour utiliser les techniques nouvelles. L'agriculteur devient un industriel et un commerçant, il prend son rang dans la bataille économique; et n'est-ce pas dans la lutte que les volontés s'affermissent et que les coeurs se haussent vers un plus noble idéal? (Laribé).

IL Y A UNE FOI...

Au coeur de tout peuple et de toute assemblée d'hommes qui montent parmi les nations, il y a une foi. C'est la vie elle-même qui pose le dilemne: Crois ou meurs. Celui qui ne croit pas que son action sera comptée dans le mouvement du monde, pourquoi se dépasserait-il? Pourquoi même entreprendrait-il une oeuvre? Mais celui qui est mu par une foi, celui-là ne craint pas de construire en vue d'un avenir qu'il ne connaîtra pas mais vers lequel il sait qu'une pensée supérieure dirige ses efforts et ceux de ses frères. L'homme ne cherche point la prospérité pour elle-même; il ne la trouve guère lorsqu'il en fait l'objet de ses désirs, mais s'il fait don de son oeuvre à Dieu, c'est alors que la prospérité lui est donnée. (Valois).

ECHOS DE LA DERNIERE ASSEMBLEE.

La Société des Agronomes Canadiens de la province de Québec a tenu, le 29 avril dernier, à Montreal, une assemblée importante, dont les échos se répéteront jusque dans les montagnes du comté de Frontenac.

Assemblées particulières.

Les Sections de Québec et de Montréal ont d'abord, pendant quelques minutes, siégé séparément.

Elles ont demandé à leur secrétaire respectif de rédiger et d'adresser aux délégués les résolutions qui doivent être présentées à la convention générale du mois de juin.

Il a été proposé:

Qu'au cas où un agronome, membre de la Société, aurait à se plaindre de représentations concernant son service ou d'accusations de nature à lui porter préjudice, faites par d'autres que ses supérieurs immédiats, il en informe immédiatement le secrétaire de la Section à laquelle il appartient.

Elles ont encore apprécié, très hautement, le travail déployé par le Secrétaire de la Société, M. F.-H. Grindley.

Assemble générale.

Les Sections de Québec et de Montréal se sont ensuite réunies en assemblée générale.

La discussion a porté sur deux principaux points: l'enseignement agricole et le geste du Dr Grégoire.

Après la discussion sur l'enseignement il a été proposé:

Qu'un comité, qui sera appelé "Comité de l'Enseignement Agricole", composé de MM. A.-T. Charron, J.-N. Ponton, Georges Bouchard, J.-C. Magnan et F. Létourneau, soit chargé de préparer les cadres pour l'établissement d'un système complet d'enseignement agricole dans la province de Québec et de formuler un programme qui sera étudié à une assemblée conjointe des deux Sections françaises et présenté à un congrès des autorités pédagogiques et des techniciens agricoles convoqué à cette fin.

L'affaire Frontenac a retenu l'attention des membres pendant une bonne heure. Il en sera question dans le prochain numéro. En attendant les négociations se poursuivent.

Durant la soirée, une dizaine de membres de la Section Macdonald se sont joints aux deux Sections françaises et on a discuté le programme de la convention générale, en particulier le projet de notre président, M. Klinck, relatif à l'unification de l'enseignement agricole, le bureau de placement, la question des membres réguliers, honoraires et "associés".

L'ELECTION

Les membres de la Société ont réélu, comme président de l'exécutif national, M. L.-S. Klinck, de l'Université de Vancouver, comme premier et deuxième vice-présidents, M. H. Barton, du Collège Macdonald et John Bracken, Président du Collège d'Agriculture du Manitoba, et, comme secrétaire-honoraire, M. L. H. Newman.

Le Dr. A.-P. Charron représentera notre Province dans le Conseil national de la Société.

La Revue Agronomique, tout en déplorant la défaite des candidats canadiens-français, félicite les nouveaux élus.

LE FACTEUR INTELLIGENCE.

Le propre de la civilisation et surtout de notre civilisation industrialisée est d'intellectualiser l'effort de la création économique. Si nous avons la volonté de surmonter la crise où nous sommes, c'est à l'intelligence qu'il faut faire le plus pressant appel. Donnons-lui le rang, l'honneur, les soins, la rémunération qui lui sont nécessaires. Dans notre civilisation qui paraît dominée par les forces matérielles, c'est l'intelligence qui porte partout l'animation. Sans elle, la machine n'est que vile ferraille (Valois).

La Société des Agronomes Canadiens

Première Convention Annuelle

A

L'Hôtel "Royal Alexandra", Winnipeg, Manitoba.

LES 15, 16 ET 17 JUIN, 1921

Des questions de la plus haute importance pour le pays seront discutées par les représentants, au Canada, de la pensée agricole.

Le Lieutenant-Gouverneur du Manitoba, le Ministre et le Sous-Ministre de l'Agriculture, le Maire de Winnipeg et le Président du Collège d'Agriculture de la Province, souhaiteront la bienvenue aux délégués, aux membres et aux autres personnes qui assisteront à la convention.

Pour tous renseignements regardant la convention, son programme, etc., s'adresser à FRED. H. GRINDLEY, Hôtel "Royal Alexandra", Winnipeg, Manitoba.

Nos amis du Manitoba sont à s'organiser pour rendre aux membres de la Société leur séjour dans l'Ouest le plus agréable possible.

Nul doute que cette convention sera un succès, et nul doute aussi qu'il en résultera beaucoup de bien pour le pays, tant au point de vue matériel que social.

VOLUME I. JUNE, 1921. NUMBER 6

Scientific Agriculture

HON. G. H. MALCOLM.
Minister of Agriculture for Manitoba.

La Revue Agronomique Canadienne

CONVENTION NUMBER

Canadian Society of Technical Agriculturists

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Scientific Agriculture

Official Organ of the Canadian Society of Technical Agriculturists

A Magazine devoted to the general advancement of Agriculture in Canada.

Published in the interests of Agricultural Science and Research.

Vol. I. Gardenvale, P. Q., June, 1921. No. 6.

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Published Monthly by the Industrial and Educational Publishing Company, Limited, Garden City Press, Ste. Anne de Bellevue, P. Q. 'Phone 165.

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Editor and General Secretary—FRED. H. GRINDLEY.

Subscription to any address in Canada, the United States, or the British Empire, $2.00 yearly; other countries, postage extra.

Changes of advertisements should be in the Publishers' hands ten days before the date of issue.

La Revue Agronomique Canadienne

EDITORIAL

Some Impressions of the Convention

Those who attended the First Annual Convention of the Canadian Society of Technical Agriculturists, held in Winnipeg a week ago, must all have received certain impressions. Certainly there must be, among those impressions, some that were more forcibly impressed than others, and will therefore remain longer within the memory.

Looking back at the social parts of the three days' proceedings, the most outstanding features were the geniality and enthusiasm of Deputy Minister Evans, the genuine sincerity of the welcome given by Mayor Parnell at the Civic Luncheon and of Secretary Milner at the Board of Trade Luncheon, and the cordial reception of President John Bracken and his staff at the Agricultural College on June 16th. All of these officials gave the visitors a whole-hearted welcome, typical of the western spirit of hospitality. There can be no doubt that much of the enthusiasm which was so apparent during the entire three days, was due in no small measure to the work of the Reception Committee, which arranged a splendid social programme under the direction of Mr. Evans.

Added to the features above mentioned, and of no less significance, were the personal attendance of the Lieutenant-Governor and the splendid co-operation rendered by the press. Sir James Aikins showed a keen personal interest in the Society and a wide knowledge of the many problems confronting agriculturists; he gave an address which indicated, not only his ability as a speaker but his convictions as to the future success of the C.S.T.A. The credit for the publicity given to the proceedings of the Convention may be given, to a very great extent, to Miss E. Cora Hind, commercial and agricultural Editor of the Manitoba Free Press. Miss Hind's knowledge of agricultural affairs is world-wide, and her interest in the Society and in the proceedings of the Convention is, to say the least, significant.

So far as the results of the business sessions are concerned, an effort has been made to give them quite fully in the present issue. The address of President Klinck is printed in full, and should be carefully read by all who receive this magazine. The prolonged applause which greeted President Klinck at the close of his address indicated that he had touched upon many vital points, that he had pointed the way towards a solution of many problems which have already confronted the Society during its difficult organization period, and that he realized full well the difficulties still to be met and overcome. He left no doubt in the minds of his audience as to the need for such a society as the C.S.T.A., and showed quite plainly the various functions which it could perform to the advantage of its members and of the agricultural industry.

The dominion-wide growth in the Society, the keen interest of the members and the solidarity of the various branches were another feature of the Convention. Every one of the thirteen branches was represented and it is unfortunate that lack of space will not permit the publication in full of the many favourable reports submitted. It is sufficient perhaps to say that progress was indicated in every province and a rapid increase in membership is anticipated during the coming year.

The reports of the General Secretary and of the Committees on Research and on Marketing Education, the Amendments to the Constitution and By-laws, the personnel of all new committees and of the Editorial Board, details of the proposed Bureau of Records, as well as numerous other items concerning the Convention, are all embodied in this issue which

Canadian Society of Technical Agriculturists. First Annual Convention Group taken at the Manitoba Agricultural College.

should form a useful reference and record. The importance of many of the decisions reached cannot be too greatly emphasized, and in many directions definite progress is to be expected.

On such questions as agricultural policies, which occupied one entire session of the Convention, there was one noticeable feature in the discussions, and that was the lack of criticism or complaint. Contrasted to the discussion on the same question a year ago at the Organizing Convention, a distinct change was noticeable. There was, of course, no denial of the fact that in certain directions needed adjustments and more clearly defined policies were needed, but the fact that the various agencies — federal, provincial and college — are working together, collaborating, co-ordinating and co-operating to a noticeably greater extent, is a hopeful sign, and may be accepted as an indication that these agencies recognize the existing inconsistencies and duplications of effort and are willing and anxious to assist in solving them.

J. H. Evans, Deputy Minister of Agriculture for Manitoba.

President John Bracken.

The high tone of the discussions, the enthusiasm, the desire on the part of all to assist a national movement to raise the status of agriculture as a science, the lack of criticism, the encouraging messages from all the provinces in the Dominion — these features were noticeable at every turn. The decision to assist the operations of the local branches by turning over to them twenty per cent of the membership fee, was the result of a recognition that progress must now be made by these organized branches in order that the interests of the members may be best cared for and their enthusiasm sustained.

Of the future progress of the Society, and its importance as a vital factor in the agricultural advancement of the country, there can be no doubt. The organization has a clearly defined policy, plainly stated objects, and definite lines of work mapped out for immediate accomplishment. It has nearly six hundred members, and this number is increasing steadily; it has thirteen local branches, all of which are keenly appreciative of their local needs and conditions; it has seven committees, each giving consideration to various phases of the Society's activities; and it has, directing the advancement of the whole organization, its branches and its committees, a Dominion Executive Committee, the members of which are fully aware of the aims and objects and of the means to be employed in accomplishing the ends sought.

There is no apparent barrier to further progress. If every member gives his personal assistance by taking a personal interest, the Canadian Society of Technical Agriculturists will make tremendous strides before it holds its second Annual Convention in Montreal next year.

CONVENTION NOTES.

Eighty-four members registered their attendance at the Winnipeg Convention.

Copies of the group photograph, 14 inches wide by 6 inches deep, may be obtained by mailing one dollar to the General Secretary. The photograph is reproduced, in small size in this issue.

The Next Convention will be held in Montreal, probably in June 1922. Every member should plan to attend.

Members who have not yet furnished the chairman of the Committee on Research with a list of problems requiring research, or upon which research work is now being undertaken, should promptly do so. Any who have sent in such lists, and who do not want them to be published, should so state. Such communications should be addressed to Dr. J. M. Swaine, Entomological Branch, Dept. of Agriculture, Ottawa.

It is unlikely that the Editorial Board will function for some months, or until such time as ample material is available for publication. The personnel of the Board is published in this issue.

Presidential Address

By L. S. KLINCK.

The responsibilities which devolve upon the incumbent of the highest office in the gift of the technical agriculturists in Canada are many and varied, and not the least of the duties expected of this officer is the preparation and delivery of the presidential address. As this is the first Annual Convention of the Society it cannot be said that custom requires that such an address be given, but doubtless future executives will regard this evening's proceedings as a precedent and so will impose one more official duty on all succeeding presidents.

This evening your chief executive officer finds himself without precedent for his guidance and without a body of tradition for a background. Although in a sense, it is more interesting to create traditions than to be bound too rigidly by them, yet most of us prefer to follow the well beaten paths rather than to blaze trails for ourselves and for others. It is, therefore, with no

President L. S. Klinck.

small degree of trepidation that I assay the task of deciding what issues should be considered as primary and what as secondary; what ones should be emphasized and what lightly passed over; what ones should be stressed and what omitted.

Before undertaking this duty, permit me to express my deep appreciation of the honour you have done me in electing me, for the second time, president of the Canadian Society of Technical Agriculturists. I am not unappreciative of the honour which the membership of this society has conferred upon me. It is a distinction I value most highly and I shall continue to do my utmost to justify the confidence you have reposed in me.

I wish also at the beginning of this address, to express my personal appreciation and thanks to the members of the executive who have so loyally and successfully labored during the year for the advancement of the principles for which the society stands; and especially do I wish to pay tribute to the efficient and untiring services rendered by the General Secretary. To the many vexed questions incident to organization and administration he has brought to bear persistency, energy and enthusiasm which, coupled with organizing ability and tact, have done much to promote the interests of the society. Without discussing the report presented by him this morning I cannot refrain from expressing my gratification at the progress which has been made by the society during the past year, and especially at the large measure of success which has been achieved in several directions, more particularly in organization, membership, publication and finance.

The society has made steady, uninterrupted progress since its formation one year ago. Its accomplishments have not been spectacular; but they have, I believe, been such as to ensure permanence. Now that the Society is truly national, now that it has an official organ, now that its aims and objects are becoming better known, and now that it is attracting to its membership an increasingly large number of the foremost men engaged in technical, scientific and professional agriculture, your executive feels that the time has arrived for an energetic prosecution of its aims and objects.

Before this can be successfully undertaken, however, these aims must be more definitely defined, and the means to be employed to attain the ends sought must be carefully wrought out. This is a task for the Dominion Executive, for the Provincial and Local Executives, and only in somewhat lesser degree, for each individual member. It is a task worthy of the best thought and sustained effort of our ablest and most experienced teachers and administrators.

For those who are not personally acquainted with the members of the Executive I perhaps should say that they are easily approachable and that they have not yet been seized with an acute attack of "incipient Caesarism." On the contrary, they are open to, and will welcome suggestions. In the name of the members of the Dominion and Provincial Executives I extend an official, but not a formal or perfunctory invitation to all technical agriculturists to take an active part in the determining of the society's policies and in the giving of the fullest effect to the same.

The necessity for the adoption of this principle in the government of the society is obvious. Its importance cannot well be over-estimated. Its unqualified acceptance will contribute more than any other one factor to the finding of a satisfactory answer to the question, "What will I get out of the Society?", or the still more frequent question: "What can the Society do for the agricultural profession and for the agricultural industry?" Both of these questions are pertinent; both demand an answer, and the Society should immediately

proceed further to justify its existence, and by its achievements give a sufficient and conclusive answer to these oft-propounded questions.

Last year at Ottawa some very pessimistic notes were struck. Some of these were personal, some were professional, but the discussion which followed helped to clear the atmosphere and indicated to those of larger faith the way out of the, at times, "encircling gloom."

Admitting that a few of the objections raised a year ago had some foundation in fact, what do we see today? We are evolving a working policy. We have more clearly defined objectives towards which we are moving. We are co-operating, co-ordinating and collaborating as never before. We have been accorded infinitely more unexpected support than we have encountered oposition. We have not gone out of the way to attack any individual or organization and we have not stressed matters pertaining to our personal or corporate advantage. In a word, we have tried to be progressive without being radical, fearless without being offensive and have moved as "expeditiously as possible," which we, too, have interpreted to mean as slowly as will give most promise of ensuring permanent success.

In all progress the time element is a factor. A national organization cannot be effected by any magic incantation, and after it has been perfected it has taken but the first step towards the accomplishment of the end sought. Its real problems lie before it. The Canadian Society of Technical Agriculturists now has the first opportunity to make its contribution to the solution of those problems, the existence of which first called the organization into being.

Today, nearly half a century of practical experience and of honest and efficient endeavor lie behind the oldest agricultural college in Canada. In the face of strong opposition it has made a lasting contribution to the national life and has slowly but surely won its way. And yet there are those who question whether they, as individuals, or the province as a whole, has profited materially by the existence of the college,—whether, in short, the increased financial return has offset the heavier tax they have been called upon to pay for support of this institution of higher education in agriculture. To such honest but uniformed criticism an effective answer can be given. In matters material, as well as in those of the mind, the answer is writ large for those who have eyes to see and the wisdom born of understanding.

Into a less restricted, but not less definite field, the Canadian Society of Technical Agriculturists has entered. The work is a pioneer one. The immensity of the task gives thoughtful men pause. The number and the importance of the problems requiring study proves at once the inspiration and the despair of those who first conceived the idea of organizing the technical agriculturists in Canada. Heretofore the magnitude of the task has acted as a deterrent. Now let us hope that the size and number of the problems will so appeal to us as to constitute an impelling force which shall carry us forward to success.

There are those who have broadly intimated that the Society was organized with "a fine careless rapture" which carried the Ottawa convention far out upon an uncharted sea. But, unfortunately for those who hold this view, the weight of evidence is against them. On the contrary, there was the fullest recognition that facts are stubborn things and that there was urgent necessity for the Society to get down to stern practicalities. To-day, it is even more imperative that we keep in mind the basic facts in relation to Canadian agriculture, that these facts determine the course to be taken and that with these before us we proceed to formulate policies which shall enable us to accomplish the desired ends.

But unless an organization functions and functions efficiently, no one is under obligation, financial, moral or otherwise, to give it his support. To its own constituency an organization must stand or fall. We feel, therefore, that one of the first steps in this convention is to clear the ground of objections, and to answer, as fully as may be, the questions of those who do not find themselves in heartiest sympathy and in fullest accord with the objects of the Society.

Movements and institutions, whether great or small, need criticism. But such criticism ought not to be left wholly to the opponents of these movements and institutions. Those directly interested should be the ones to press most persistently for needed reforms. Your executive therefore will welcome every constructive criticism and suggestion that any member may have to offer.

And what is true of the attitude towards this Society is equally true of our attitude towards the Departments of Agriculture, Dominion and Provincial and of our attitude towards the Colleges of Agriculture. The time is ripe for deep heart-searchings among agriculturists in Canada. Certain conditions exist for which remedies should be sought and applied immediately. Some of the situations which confront us have been with us for years; but we have ignored them or else have neglected to meet them with any definite comprehensive policy. A satisfactory solution of these problems must be preceded by a recognition on the part of all, that great questions should be regarded purely from a public point of view; there ought not to be any divisive interests in a well organized system of agriculture in this country. We are all engaged in parts of the same common task. The best test of our fitness, as a society, to render service to the profession and to the industry is to be found in our ability to undertake our particular task in a big way and then carry it to a successful conclusion.

What are some of the objects of this society and how may they be most successfuly attained? To ask this question is to raise the largest issues in which the Society is, or may become interested. Some of these questions, as I have already stated on a previous occasion, are primary: others are clearly secondary. Some are comprehensive and far-reaching; others are comparatively restricted in their scope. Some are capable of realization in the immediate future; others call for years, possibly decades, for their accomplishment. Some are largely dependent for their attainment upon executive foresight and initiative; others can be brought to full fruition only as the result of sustained interest and aggressive action on the part of the great body of the membership. Some relate themselves to members of the society only; others, and happily by far the larger number, have to do with the raising of the standard of the service to be rendered to the agricultural profession and to the industry as a whole.

The objects of the Society have been very briefly and succinctly set forth in Article 2 of the Constitution. I take it that with these objects all the members are in

accord, although it is not reasonable to assume that all will agree as to their relative importance. Fortunately, it is not essential that in this unanimity of opinion should obtain; but it is surely not without significance, that, after providing for organization, the maintenance of high standards in the profession should have been the first object specified by the Ottawa Convention.

Permit me at this point to preface this part of my address with the statement that, in my judgment the paramount issues of immediate, pressing importance which should engage the earnest consideration of the members of this society, are three in number, viz: (1) Agricultural education, in the broadest acceptance of that term; (2) Agricultural policies—Dominion, Provincial and College and (3) Organization of technical agriculturists, from the standpoint of the individual as well as from that of the profession.

Growing out of these, but very closely related to them, we have many secondary issues such as: (a) the official publication, (b) Finance, (c) Fees, (d) Locals, and (e) Survey of Agricultural Education.

Time will not permit of more than a passing reference to certain phases of the more important of these issues and none whatever to the most of them. However it is the intention of your executive that these questions will all be dealt with in the reports of the committees or in the discussions during the sessions of this Convention.

As educators we have, as a rule, good material to educate. We have the foundations upon which to build; but at present we are taxed to the limit to admit all qualified students, and, unfortunately, are compelled to consider ways and means of keeping our enrollment down. Arbitrary limitation of student attendance will not long be tolerated by the public; but for the present we are confronted with the question of raising our standards, of increasing our fees, of excluding partial students, of raising the unit-number in our classes, or perhaps of doing all four, because the number of students seems to be increasing, in almost geometric ratio. Surely in this field alone there are ample opportunities for effective work for every member of the society who is interested in agricultural education in one or more of its various aspects. Some of the more recent educational experiments in agricultural teaching have greater pedagogic consistency than the old, and have been evolved largely as the result of a careful re-examination of the curricula of other colleges.

True, each college has its own constituency, its own regional environment, its own peculiar type of problems. Our courses, however, are, or should be, determined by the needs of the community they are designed to serve. Through this society these experiments in education might be expanded, and made even wider in their application. No one in search of a practical educational problem, which has a direct bearing on agriculture in all its phases, need go beyond this to find one worthy of his best endeavour.

Let us place, then, at the head of the list of objects towards which the society should work, insistence upon higher academic standard for undergraduates and larger opportunities and better facilities for post graduate courses.

And the second, namely, greater insistence upon, and more adequate provision for, investigation and research is, in importance like unto the first. The attainment of a measure of success in these two directions will contribute directly towards and will render significant service to, the cause of securing better qualified instructors on the teaching staffs of our colleges. As the result of more thorough training there will inevitably follow, quite aside from organization, a more generous recognition of the services of agricultural graduates so long as they combine, in the present high degree, a willingness to labor with the hand as well as with the brain.

No other decision of the Ottawa Convention was more encouraging or was fraught with greater possibilities for progress than was this. In their attitude towards this question the delegates showed that they realized the importance of higher academic standards, that they were prepared to face the issues squarely, and unitedly to bend their energies to the accomplishment of this fundamental task.

Under the general heading of education permit me to say a few words about research. The treatment will necessarily be very fragmentary because it is designed primarily to emphasize one important point which is, I fear, all too frequently overlooked. Research has never been understood by the general public in this country, nor can we reasonably expect it will be until it has been interpreted, concretely, by investigators for every class of our agricultural population. Because teaching is better understood than is original research, we are often told that the first duty of the colleges of agriculture is to teach, and that investigation and research can wait. Not infrequently the penalty of such a policy is a species of "intellectual parasitism" and a growing inability on the part of some instructors to profit by the more advanced work of others.

Research is not something apart from the legitimate function of a college. On the contrary, it is an integral part of any progressive institution's work. As such, it should not be left to chance, or receive attention only after apparently more urgent needs have been met. A definite sum should be set aside for this purpose in the budget and annual reports of progress should be submitted to the administration the same as teaching departments are required to do. Not infrequently many research workers constitute the barrier to their own progress, and to that of their fellow-workers, by being disposed to stress unduly, the independence of the investigator; just as some teachers attach undue importance to what they term "academic freedom." The investigator is justly entitled to as much consideration and recognition as the teacher, but not more. Like the teacher, he must have a definite program, and his results must be made available to the public. Moreover he is the man who should present the results of his creative power to the people whenever his findings lend themselves to such treatment.

Given, then, a program, reasonable facilities for work and the means of giving due publicity to the results, investigators and their work will receive more generous recognition and will not leave themselves so open to the oft-repeated charge that the mystical work "research" is imployed to provide another means of "giving lazy professors more time to loaf."

In some quarters we have had all too much reason to suspect that this idea has obtained such a firm foothold that a long and aggressive campaign of education will be necessary to disabuse the public mind of this wholly erroneous conception.

The second important object of the society, as we have noted, is the bringing about of more co-operation between the workers in the Dominion and Provincial Departments of Agriculture, and these, in turn, with

those who are engaged in college work. You will be gratified to know that the importance of this subject has been recognized by your executive and that it has been given a prominent place in the program of this Convention.

Even casual observation during the past few years discloses the fact that long-established standards with respect to personnel and creative performance in government and in college circles are extremely difficult to maintain. While a certain percentage of change in the personnel of an organization is often desirable, and sometimes even beneficial, it is nothing short of a calamity when an efficient organization is disrupted, or its morale lowered from the lack of financial support. To-day specialized training and years of experience are required before technical men attain to full efficiency; and it has become increasingly evident, especially during the last three or four years, that it is well nigh impossible to maintain previous standards since, in the appointments to fill vacancies caused by resignations, individuals of equal academic attainments, ability and experience will not accept these positions under present salary schedules. The inevitable result in many cases has been a lowering of teaching and investigational standards. The demand from the business world is for the highest grade of men, men trained professionally and with an aptitude for administrative affairs. As a result, the colleges and the Government service have found that many of their most valuable men have reluctantly decided to resign; and unfortunately, in some cases, the less efficient have remained. The net result has been that colleges and Government Departments have in effect, become training schools for private business. This is particularly true in the upper grades where the disparity between the salaries paid government and college men and those paid for positions of corresponding grade in business, is more pronounced. Fortunately the pendulum is beginning to swing back, but in the interval, many of the ablest men in Governmental or in College work have been lost to the profession.

Some technical associations have recently been formed in Canada whose first objective is increased public recognition of technically trained men and adequate remuneration for professional services rendered. To this end they have secured protective legislation and have endeavoured to discourage the bringing in of technically trained men from other provinces. The members of these associations base their case upon the fact that this is an era of applied science; that knowledge and professional experience are essential in the successful doing of the world's work and that this knowledge and professional skill have been acquired at great expense in time and money. Several of these associations have drawn up and have approved schedules for pressing their claims upon individuals and corporations requiring the services of their members. They are now seeking to effect a Dominion-wide organization so that their influence may be brought to bear throughout the whole country.

Unquestionably technical knowledge and skill justly entitle the possessor to professional standing, to merited recognition and to financial returns commensurate with the service rendered. On the other hand, state, or private individuals have contributed generously to the training and education of these men—a consideration which ought not to be lost sight of in the discussion of this question.

Technical agriculturists have been among the last of the professional men to organize. They have much to learn about themselves as members of a profession and still more as regards educating the public to place a proper valuation on their services. This in itself will call for the expenditure of time, of money and the development of an *esprit de corps* on the part of the members of this society. When our members speak of attaining the ends sought by other organized technical workers it rests with themselves to determine what course shall be pursued and how far the society is prepared to go.

Last year no attempt was made to stress the question of increases in salaries. No one is more anxious than I am to see this long-overdue recognition given; but subsequent events have proved the wisdom of those who kept this issue in the background last year, and I should add that I am not in favour of making it a major issue now. To increase one's own salary, or to bend one's greatest efforts towards that end, is never regarded by the public as constructive work. And in this the public is right.

This is the day of organization. As graduates of agricultural colleges we have been pioneers in organizing others but we ourselves have always depended very largely on individual initiative. As a result we are sometimes difficult to drive in pairs.

The interests of agriculture and of the technical men engaged therein can no longer best be served by individuals working singly or in small, isolated groups. The issues involved have become too large and the ramifications too numerous and far-reaching for individual action to be effective. Associative action need not take the form of an attempt primarily to improve our individual or collective status, but it is important that we organize so that the profession may not suffer because of our inability or unwillingness to act together.

Last year, in concluding my address before this society I said: "The suggestion that a small body of individuals with an intimate personal knowledge of the requirements of Canadian agriculture, but preferably not officially connected with any of the three branches mentioned, make an exhaustive study of the whole question of the division of fields of work and of Government assistance thereto in all its phases, is one upon which I cannot now improve". Time has emphasized the necessity for some form of effective action and has shown its enlarged possibilities.

As technical workers, we profess to believe in the scientific method. We are at a loss to know how to proceed unless we have the necessary data—the basic facts. These, we believe to be essential to an intelligent approach to any problem and absolutely necessary to the formation of wise, far-seeing policies. But I submit that we do not have the data required nor have we made any attempt worthy the name, to get it. We speak of formulating progressive, forward-looking programs, but all the while we know better than anyone else the limitations under which we continue to labor.

To secure the data we require on any of the main points I have enumerated above, would cost more money than this society has at its disposal; but I should like to see a beginning made by means of a "self survey" in which an exhausted study of one of these larger questions would be taken up by the society. The information gained in this way would be of the greatest value from an educational as well as from an administrative point of view. Through such a survey the experience of one would be available for all, so that

"over against our common task we might set the strength and wisdom of our common experience".

It we do not do this ourselves, and that speedily, we may confidently anticipate that it will be done for us. Our Colleges and Departments of Agriculture are large; their demands are heavy and the increase in annual expenditure is causing legislators and the people no little concern.

Agricultural education in one or other of its various forms has reached a point where it is imperative that mal-adjustments be remedied, that functions be redefined, that a more perfect articulation be effected and a unified and consistent policy be evolved. Surveys, national in scope, must underlie these determinations, because back of these lies the problem of public support. The assumption that an interested and favorably disposed public will furnish the necessary funds has not always been borne out by the facts, as witness recent events in the East as well as in the West. The wise expenditure of public funds has always been important but it is doubly so at the present time.

Agricultural education, whatever its form is, in essence, a unit—a single enterprise—and the policies of the department cannot longer continue to be a matter of indifference to any other. This is a concept which will continue to grow and something must be done, not only for the information of the public, but for our own protection as well.

I am in no purely destructive or critical mood, but I submit, gentlemen, that if we do not study these and other equally important questions, then we lack the courage and resolution to attempt the things which most need to be done; and, if that is the case, the sooner we realize the true situation and govern ourselves accordingly the better it will be for ourselves and for the profession we claim to represent.

Report of the Committee on Research

A List of Research Problems and Investigations of Particular Importance to Canadian Agriculture.

Prepared by Dr. J. M. Swaine, Chairman of the Research Committee of the C.S.T.A.

The Committee on Research has attempted the compilation of a list of problems requiring further research or investigation under Canadian conditions. It was the original intention to confine the list to problems in fundamental research; but it was eventually decided to include experiments, tests and surveys, and any important agricultural subjects.

A letter was sent to many of the prominent agricultural workers in Canada requesting their assistance in the preparation of two lists of agricultural problems; one, of problems requiring further investigation under Canadian conditions, and the other, of problems already in progress in Government or University departments in this country. A large number of lists of problems was received, and from these the present list has been largely compiled. In several cases long lists were included almost exactly as received.

Since many contributors did not distinguish between problems recommended for attention and those already in progress no distinction is made in this preliminary report.

It was hoped that the publication of a long series of problems of this kind would have some effect in stimulating agricultural investigation. It seemed possible that it would be of assistance to younger workers and particularly to graduate students in selecting their problems, and that it would be an emphatic reminder to the older investigators, to those in charge of departments and to all who are able to influence the prosecution of agricultural research, that agriculture in Canada is in very great need of the addition of many trained men, skilled in investigation and experiment. It appears that with many problems we are able to attain only a certain level of progress, owing apparently either to excess of work crowded upon the investigator or to the investigator's lack of proper research training. If this list emphasizes our great need for additional research into the fundamental problems of Agriculture it will serve a useful purpose.

Several correspondents have questioned the advisability of publishing a list of problems now in progress since this might result in the loss of priority or credit by the investigator who was responsible for the real progress made in the study. It is probable that this would happen only rarely and that a careful statement of the problem would nearly always avoid any such contingency. In this connection it may be said that while it is only just that an investigator should receive all proper credit for his scientific work, the advancement of science is a much more important consideration.

If a list of problems in progress is desired it might be better to leave this list in the hands of the general secretary to be used in promoting co-operation between investigators when this is requested.

The list, as submitted herewith, is far from complete. Many contributions were received only recently and the compilation was of necessity rather hastily done. If the Convention decides to publish the list in the Journal, other problems could be added before publication and an improvement could be made in the form of the list by more careful editing. It would also be possible to give further details of many problems now in progress if this were desired.

The Committee wishes to express its obligations to the scientific workers who have assisted by submitting lists of problems.

The names of those who have assisted the Committee are:

H.S. Arkell, J. Adams, A.F. Barss, H. Barton, G.R. Bisby, P.A. Boving, Geo. B. Boving, W.H. Brittain, F.W. Brodrick, Geo. H. Clark, L. Caesar, F.M. Clement, H.G. Crawford, H.H. Dean, B.T. Dickson, M.B. Davis, F.C. Elford, A. Gibson, M.C. Herner, F.C. Harrison, V.W. Jackson, M.A. Jull, L.S. Klinck, H.M. King, E.A. Lloyd, W.T. Ma-

coun, L.H. Newman, L.C. Raymond, Chas. E. Saunders, F.W.L. Sladen, Geo. E. Sanders, W. Sadler, J.D. Tothill, R.C. Treherne, F. Torrance.

Editor's Note:

The complete text submitted to the Convention in Dr. Swaine's report covered forty-eight typewritten pages, including numerous problems in each of the following divisions of agriculture: agronomy, animal husbandry, bacteriology, botany, cereal husbandry, chemistry, dairying, entomology, horticulture, poultry husbandry, veterinary science, and miscellaneous. In all there were well over five hundred problems included in the report.

In the absence of Dr. Swaine, the report was presented to the Convention by Dr. W. P. Thompson of the University of Saskatchewan, who emphasized the importance of not publishing the report until the consent of those who had sent in lists had been obtained. Ultimately the list, after further revision has been made, will be published. In the meantime, those who do not wish to have their lists published should notify Dr. Swaine, and any who have not already submitted lists but who have such lists available should send them in so that they may appear in the published report.

In most cases — in fact in all cases if necessary — it will probably be found desirable to publish the names of those who are carrying on investigation work at the present time in connection with any of the listed problems. If possible, the published list should also indicate which problems are already being investigated, and which require investigation.

The Nominating Committee of the Convention recommended that the Committee on Research for the coming year be as follows: Dr. J.M. Swaine (Chairman), W.P. Thompson, A.T. Charron, J.W. Crow, J.F. Snell, M. Champlin, H. Barton and E.S. Hopkins. The five first named constituted the committee last year, and the three last were added to represent the divisions of soils, crops and live stock for the coming year.

A resolution brought in at the close of the Convention read as follows:

"Resolved that the present Committee on Research be maintained with power to add to their number in order to complete the compilation, revision and classification of the list of research problems and investigations of particular importance to Canadian agriculture, submitted at this Convention, the classified list when completed to be published in the official organ of the Society."

Bureau of Records

The decision of the members to form, within the Canadian Society of Technical Agriculturists, a Bureau of Records, is a very important step, and one which should be received with equal favour by the members and by Departments, Colleges and firms which employ men and women technically trained in agriculture. Preliminary plans will be commenced at once by drawing up a questionnaire which, with the approval of the Executive, will be sent to every member of the Society. At a later date the co-operation of Departments and Colleges will be sought, as well as of many commercial firms so that the Bureau may function to the fullest possible extent and in the most useful manner.

In introducing this question before the recent Convention of the C.S.T.A. in Winnipeg, President Reynolds said, "It has been proposed that in the office of the General Secretary of the Society there shall be established a Bureau of Records, to contain information as follows: a list and index of technical agriculturists in Canada, showing their academic standing, their technical training, their professional experience, their present position, and the type of position desired. Along with that indexed information, which will need to be quite exhaustive, should go a classification of positions available for technical agriculturists in Canada, with the qualifications required in each position. Available positions would cover teaching, extension work (including agricultural representatives, county agents, etc.) investigation, administration, supervision (such as directors of farms, etc.) and journalism.

"The service that it seems to me will be rendered by such a Bureau will be first, and perhaps chiefly, to those seeking employment, but service will also be rendered to colleges, governments and firms which are seeking men. I am convinced that such a Bureau, if accurately established and efficiently operated, consisting of an exhaustive index of men and positions available, will be of great service, both to the members of this Society as well as to employers of technical agriculturists of all kinds.

"We have all of us had applications from friends for recommendations when they are applying for positions, and either to comply with those requests or to decline, is equally embarrassing. You are supposed to say something to help the man to his goal, and in doing that you are in danger of being insincere if not positively untruthful at times. These testimonials from friends are now pretty well discredited and are usually of little or no value.

"We want something, nevertheless, which will have the necessary accurate information with respect to prospective appointments. Such a Bureau would be of immense value to the heads of Departments and Colleges, who are frequently asked to give testimonials.

"The available information is, after all, information which is to be of service to both parties concerned. To place a man in a position just because he wants it, is no permanent service to the man or to the position, but to place him in a position for which he is qualified, and for which his testimonials give evidence, should be of the greatest service to the Society as well as to all employers. If the information is gathered and indexed, granted that it is in the office of the General Secretary, then I should think the next step would be for the General Secretary to notify all employers that he has the information in his office with the authorization of the Society. That should carry weight with all employers. It would carry weight, I am sure, with colleges."

In the discussion which followed, Deputy Minister Evans of Manitoba stated that he would be very glad to see such a Bureau established, if only to compile a list of men and their qualifications. Such a list should include many men without academic standing,

President J. B. Reynolds.

who were "graduates from the school of experience".

Deputy Minister Roadhouse of Ontario was of the opinion that the information available in the Bureau should not be published in any form, but that it should be available for any who might want it, i. e. those who wish to secure information that will be helpful in filling positions, and also to those who desire to secure positions. "This constitutes," said Mr. Roadhouse, "a practical, concrete service that this Society can render to the members, to the work and to agriculture". It was further pointed out that information concerning salaries need not be regarded as confidential, but should be readily given by every member; in most cases salaries are public property.

Obviously the development of the Bureau will take some time, and it is unlikely that it will commence to operate very much before the next Convention is held. It will necessarily take some time to draw up a questionnaire that will suit all cases; several months will elapse before such questionnaires are all returned, filed and indexed; the compilation of a complete list of commercial firms, to be added to the list of departments and colleges, will also be necessary. If the Bureau begins to function by January, 1922, it will have made satisfactory progress.

The resolution on this question was as follows:- "Resolved that there be established in the office of the General Secretary, of the Canadian Society of Technical Agriculturists a Bureau of Records which shall list and index information covering particulars as follow:

1. For each and every member of the Society an index card recording his academic standing, technical training, professional experience, present position and salary, type of position for which he is qualified and other information considered necessary to further the purposes of the Bureau;

2. A classification of positions or occupations available in Canada for technical agriculturists with the qualifications required and salary offered in each; such classification shall include teaching, extension, investigation, administration and journalism.

When such an index of members shall have been prepared, notice thereof shall be sent to ministers of agriculture, and deputy ministers, presidents and deans of agricultural colleges, principals of agricultural schools, directors of farms and experiment stations, managers of industrial concerns and any other agencies employing technical agriculturists, with the information that the Society is prepared to furnish a statement of qualifications of candidates for positions that may be open.

All members shall be classified and indexed according to the particular kind of work engaged in, and such indexes shall upon application be available to members of the Society."

Report of Committee on Marketing Education

Prepared by H. S. ARKELL, Live Stock Commissioner,
Ottawa.

Your Committee on Marketing Education begs to report as follows:

The Committee held no meetings as it was found impossible to convene the members at one time or place. Full discussion and consideration of the subject, however, was secured by correspondence and through personal conferences between the several members of the Committee and the Chairman. There was unanimity of view as to the necessity and advantages of courses being taken in marketing and farm business. For convenience in considering the report, the conclusions reached respecting particular phases of the question will be set down in order and a draft of courses will be submitted as outlining the different subjects which, in the opinion of the Committee, should be covered by the College curriculum.

General Observations.

1. The direction of development in farmers' thinking and in farmers' co-operative activity makes it advisable and desirable that our Agricultural Colleges should draft their courses to provide for the teaching of the science of farming in conformity with the requirements of farming as a business.

2. The objective of courses in marketing education should be to supplement necessary academic training by work which will enable students successfully to carry on their business in whatever field of commercial agriculture they may enter after leaving college.

3. In the opinion of the Committee, such courses should be developed and given by the particular Departments responsible for the teaching of the practical branches of agriculture and in definite relation of

the courses now given in the practice and science of production.

4. Courses in economics and in such phases of general farm business as are applicable alike to the several Departments of Agriculture should, it is believed, be drafted and taught under the joint consultative supervision of the professors in charge of these Departments, in order that they may be made to conform to the practical requirements of the work for which they are severally responsible.

5. It is suggested that the teaching of scientific subjects should be revised in consideration of the need that it should be related as definitely as possible to the practical commercial problems of Agriculture.

6. In the opinion of the Committee, it is both practicable and possible to adjust already over-crowded curricula in such fashion as to give undergraduate students a reasonable knowledge of marketing and

H. S. Arkell, Dominion Live Stock Commissioner.

commercial practices and a necessary understanding of values such that they may be practically equipped to take up successfully general agricultural work after leaving college.

7. It is suggested that the development and training of specialists in commercial agriculture should only be attempted in connection with post graduate work and attention is called to the fact that a new attractive field may be opened up in this direction by our agricultural colleges with advantage both to themselves and to their students.

8. Having in mind the critical business problems which college graduates will have to face not only on their own farms but as well from the national point of view it is suggested that the Convention recommend to the College authorities that they carefully and promptly review the whole question and urge the importance of necessary provision being made to equip their students more successfully to meet the practical problems which will confront them in the commercial field upon leaving college.

Outline of Courses Proposed.

1. Farm Management—Introduction to rural economics, choice of product to be grown in relation to market outlet, cost of production, farm equipment and overhead investment, elimination of waste and inefficiency in relation to economical management of land, labor, machinery, feed, power, etc., supplementary operations in relation to main lines of production, development of land fertility, maintenance of output at minimum expense.

2. Farm Business—(a) Farm conveyancing, rent, leases, insurance, practical farm book-keeping, banking, credits, loans, mortgages etc. (b) Company organization, co-operative organization, share capital, securities, stocks, bonds, collateral notes, etc.

3. Commercial Law—With reference to farm business.

4. Marketing of Farm Products—(a) Preparation of product, grading, inspection, standardization. (b) Marketing of product, community organization, shipping, weighing, transportation rates, selling, shrinkage, stock yard service, commission business, accounting, public warehousing and cold storage, etc. (c) Markets intelligence.

5. General agricultural trade, domestic and foreign—(a) Domestic—Production in Canada, domestic consumption, costs of preparing for market, costs of distribution, seasonal movements, price fluctuations, transportation costs, relation to development of allied industries, etc. (b) Foreign—Export surplus, alternative markets, transportation costs, rates of exchange, export demand in relation to competing countries, world production, world demand, world movement of supplies, establishment of world price levels, overseas agencies, efficient development of national trade, etc.

Editor's Note:

The Dominion Executive of the C.S.T.A. decided to ask the members of the Committee on Marketing Education to carry on their work during the coming year. The personnel of the Committee will be as follows:

H. S. Arkell (chairman); H. Barton, Wade Toole, G. H. Clark, F. M. Clement, J. N. Ponton and A. H. Benton.

Personnel of Committees.

The following committees were appointed at the recent Convention in Winnipeg, to hold office during the coming year:

Membership: L. H. Newman (Chairman), H. Barton, A. T. Charron.

Finance: H. Barton (Chairman), J. E. Howitt, A. T. Charron.

Progress: G. E. Sanders (Chairman), and each provincial representative on the Dominion Executive.

Affiliations: L. H. Newman (Chairman), C. E. Sanders, W. P. Thompson, J. E. Howitt, A. F. Barss.

Research: J. M. Swaine (Chairman, W. P. Thompson, A. T. Charron, J. W. Crow, J. F. Snell, H. Barton, M. Champlin, E. S. Hopkins, with power to add to their number.

Educational Policies: J. B. Reynolds (Chairman), L. S. Klinck, H. S. Arkell, M. Cumming, H. Barton.

Marketing Education: H. S. Arkell (Chairman), H. Barton, Wade Toole, G. H. Clark, F. M. Clement, J. N. Ponton, and A. H. Benton.

Address by Lieut.-Governor of Manitoba

Very cordially do we welcome you at this Convention. Your organization is to be complimented on the rapidity and efficiency with which it has been organized, and particularly are you to be congratulated on securing a journal in which you can publish your ideas and your accomplishments, and thus place the objects of the association before the people.

I understand that one of your objects is to elevate the status of scientific agriculture. "Scientific Agriculture", as you know, is a phrase received by very many practical farmers with some derision and contempt. I will not say that there is any foundation for that viewpoint, but there is some cause for it. I remember when I was a boy, in the county of Peel, that the agricultural society offered a prize for the best essay on good farming, and it was won by a man who was a particularly bad farmer. To that class belong a lot of loud-mouthed propagandists who exploit agriculture for purposes of advertisement. I know you men are interested in your subject and your society.

I am delighted to know that most of your members are young men; you have an asset that I have exhausted.

Sir James Aikins, Lieutenant-Governor of Manitoba.

You have the asset of time. You have years before you. Wisdom and cool calculation may be very desirable in mature years, but let me assure you that they will never lift the load to the top of the hill, but vigor and youth and enthusiasm will do that. You have a desire for better things, a desire to advance, and without that there can be no real progress.

You have enthusiasm — a spirit within you causing you to move in the direction you are moving, and in this enterprise you go into it heart first rather than head first. Enthusiasm is necessary for the advancement of your association.

In addition to that you have an ideal. In order that any nation may be great it must have an ideal. It is for you to realize your ideal. It is a dynamo of almost unlimited power. And you have a purpose, which means motion towards a pre-meditated end. The greater your enthusiasm the less liability there will be of deviation and the sooner will you arrive at the accomplishment of your purpose. A society with no definite purpose is a "wobbler."

Added to all these qualities you have persistency. Almost all failure results from giving up or "quitting".

Your purpose is to improve the status of scientific agriculture. To do that you must popularize your movement: you must get public opinion behind you. And you will be assisted in your work by the fact that most of the people in this country possess a real knowledge of farming. Your purpose will be made popular when the people understand that the Society's object is to cheapen the cost of production by the application of science to agriculture.

We are still only at the beginning of things. You are going to pluck more fruit from the tree of knowledge, and by applying your knowledge you are going to greatly assist in advancing Canada's basic industry. And it is mainly upon the development of our agricultural industry that this country will have to depend for the payment of her tremendous war debt.

There is one thing certain and that is that we must work. With the simple life of the country there must be an abandonment of all things that tend to lessen production. If our country becomes economical and we employ the whole of our power to the greatest extent possible, then our country cannot fail to prosper.

EDITORIAL BOARD.

Appointed at the 1921 Convention of the Canadian Society of Technical Agriculturists to assist the Editor in reviewing articles submitted for publication and in passing upon the merits of the same; and to also assist in collecting articles suitable for publication.

Members of the Editorial Board in each division will retire each year in rotation, the retiring member being eligible for re-appointment.

All manuscript submitted should be typewritten and preferably submitted in duplicate.

Whenever possible proofs will be submitted to author; they should be corrected immediately upon receipt and returned to the Editor. Requests for separates should be made when proof is returned.

THE 1922 CONVENTION.

The Second Annual Convention of the Canadian Society of Technical Agriculturists will be held in Montreal, and probably in June. This was decided at the recent convention in Winnipeg.

The International Institute of Agriculture

Proceedings of the General Assembly, November 3-11, 1920.

By T. K. DOHERTY, Commissioner for Canada, and Canadian Delegate to the Assembly.

The Commissioner of the International Institute Branch attended the meetings of the Fifth General Assembly of the International Institute of Agriculture, held at Rome, November 3-11, 1920. These meetings, the first since 1913, were under the general direction of the Permanent President, Hon. Edouardo Pantano, Italian ex-Minister of State, and under the Chairmanship of Hon. Senator Maggiorino Ferraris, also an ex-Minister. One hundred and fifteen delegates, representing 48 Governments, were in attendance, including practically all the European countries except Austria and Turkey. Great Britain and Ireland had seven; United States six, Spain, Sweden and Japan, each four; Belgium, China and Holland, each three; France eleven, and Italy thirteen.

The British delegates were Sir Daniel Hall, K.C.B. F.R.S., Chief Scientific Adviser to the Ministry of Agriculture and Fisheries, Mr. R. J. Thompson, O.B.E., Assistant Secretary to the Ministry of Agriculture and Fisheries, Sir Robert Wright, LL.D., chairman of the Board of Agriculture for Scotland, Mr. T. F. Gill, Secretary to the Department of Agriculture and Technical Instruction for Ireland, together with Mr. J. H. Hinchcliffe and Miss Laura Stephens, of the same Department, Sir Thomas Elliott, Bart. K.C.B., ex-Permanent Secretary for Agriculture and Delegate for Great Britain and the Dominions on the Permanent Committee of the Institute, Dr. C. O. A. Barber, of the University of Cambridge, recently of India, Dr. I. Levi, Assistant Controller, Egyptian Department of Statistics, and Mr. Gilbert Storey, Egyptian Entomologist.

The Proceedings of the General Assembly were, as usual, opened by His Majesty, Victor Emmanuel III, King of Italy, on whose behalf it was announced he had made an additional grant to the funds of the Institute of one and one-half million lire from the resources of his private estates. The funds are to be used for the purpose of extending and improving the Institute Palace as may be required.

In the inaugural addresses many eloquent references were made to Mr. David Lubin, the founder of the Institute, who had died in January 1919 after a notable career. It was enthusiastically and unanimously resolved that a marble bust, the work of the eminent artist, Mario Rutelli, be placed in the splendid atrium of the Institute Palace to commemorate Lubin's great work, and that the chair generally occupied by him in the Assembly Hall be inscribed with his name and remain permanently vacant as a further tribute to his memory. The ceremony of unveiling the marble bust took place on March 24th in the presence of His Majesty, the King of Italy, and a large number of diplomats, including the American Ambassador to Italy.

The Canadian Delegate is under deep obligation for the valuable advice and support of Sir Daniel Hall and Sir Thomas Elliott, whose rare administrative and diplomatic knowledge and experience were placed unreservedly at his service.

The authorities in various Departments of the Italian Government and of the Colonies and the Syndic of Rome spared no pains in assisting the deliberations of the Assembly and in showing courtesies to the Delegates.

The decisions on the financial problem were chiefly based on the full and satisfactory report of the Vice-President of the Institute, Mr. Louis Dop, of France. The contributions of many adhering countries, especially those of Central Europe, fell into arrears during the war, and the Institute's resources were otherwise affected by the rise in the cost of printing and of the personnel. Instead of the more ambitious programme of work which had been specially recommended in the Vice President's report, it was decided to provide for the carrying out of the work in hand before the war and

T. K. Doherty.

which, with an additional bonus of 500,000 lire to the staff, would require an annual expenditure of 2,800,000 lire against estimated receipts for each of the two years 1921 and 1922, under the existing contribution of only 1,351,000 lire. To meet the difference representing increased expenditure, it was decided to ask the adhering Governments to make a supplementary contribution for the years 1921 and 1922 only, equal to one and one-half times the ordinary contribution and payable by each country in its own money on the basis of the par value of the franc. The General Assembly, while approving of this necessary expenditure for those two years, deemed that the supplementary payment could be regarded only as provisional, and that the normal organization of the Institute, its administration, its staff and its work must depend on its actual financial position in 1922 on the date of the next General Assembly, in 1922.

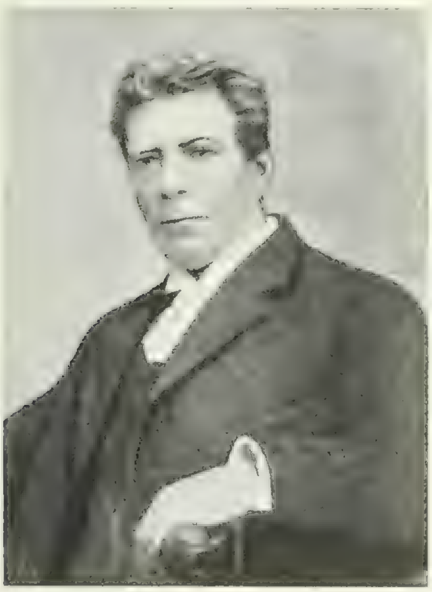
With reference to the statistical policy, the British and American Delegations insisted on the allotment of an adequate proportion of the contributions to the Statistical Services. The proposals for greater speed in the transmission and publication of crop reports, introduced at the Institute by the Canadian Delegate in 1913 and in the interval favourably reported upon by the Permanent Committee, were finally unanimously adopted by the General Assembly. Crop reports are to be henceforth cabled by the Governments to the Institute on or

before the 10th of each month, and the Institute is to cable, in return, a couple of days later a summary of the world's data. Moreover, in order to expedite the work, in addition to official information, semi-official data may, with the authorization of the Governments concerned, be used.

In connection with all the Institute's Services a system of continuous correspondence between the Governments and the Institute and the establishment for that purpose of a special Bureau is recommended on the lines followed by the Canadian Office and commended in the Institute's official report to the Assembly.

At the request of Japan, tea was added to the products to be regularly reported upon. There were introduced into the classifications of the various kinds of live stock some changes to be made in annual and census statistics, compliance with which require corresponding changes in many adhering countries, including Canada.

Favourable action was taken on the proposals made by Great Britain and Belgium asking the Permanent Committee to investigate and report to the next General Assembly the expenditure incurred by the different Governments in the interests of agriculture. Three proposals were made by the Delegations of Great Britain,



David Lubin.

Belgium and Italy, asking the Institute to publish the results of inquiries into the methods adopted during and immediately following the war for the purpose of increasing agricultural production. An elaborate scheme of inquiry was adopted, based on the carefully prepared schedule submitted by Sir Daniel Hall.

On the proposal of the American Delegation the Assembly expressed the wish that, in view of the importance of the rapid transmission of reliable information to the different Governments in respect to agricultural conditions, the condition of crops and of live stock, and in respect to available stocks and market conditions, the Institute should recommend to the adhering Governments the expediency of appointing agricultural attaches to the different embassies of the countries between which there exist importation and exportation of agricultural and animal products.

Mr. Louis Dop of France made an important and interesting report on agricultural meteorology, the conclusions of which were adopted. They provided for the creation of a Permanent Committee of Agricultural Meteorology, whose members shall be named by the Ministers of Agriculture of each country and chosen among the meteorologists, agronomists, botanists, plant pathologists, and related scientists.

The Governments are requested to ratify as soon as possible the International Convention of Plant Pathology of March 4, 1914, or approve its conclusions and consent to organize in their own countries the necessary Departments of Plant Pathology.

The General Assembly recommends that the Governments represented at the International Conference for the Control of Grasshoppers ratify the Convention of October 31, 1920 ar approve its conclusions as soon as possible.

The Governments are requested to organize on a uniform plan accountancy bureaus with a central bureau in each country, and the Institute is to utilize in its statistical and economic publications the results obtained and published by these Bureaus.

The proposal of Professor Eriksson of Sweden for the creation of an International Research Institute of Plant Pathology was favourably reported upon and adopted. The Institute is to be entrusted with centralizing all the publications and materials concerning plant pests and the enemies of plants (herbaria, collection of insects, etc.).

It was proposed that through scholarships, to be provided by Governments or private individuals, agricultural students be afforded an opportunity of visiting the Institute and spending some time there for the purpose of study and investigation, in which work they would also be aided by the Italian Government.

The Assembly adopted without discussion Mr. R. J. Thompson's proposal that with the aid of the Governments there be established a Consultative Committee of the specialists of each country for the purpose of cooperating more directly with the different Bureaus of the Institute, and meeting in annual conference in Rome.

The Assembly did not consider favourably the motion of the American Delegation that the precedent created by the Peace Conference, the League of Nations and the International Bureau of Labour in the concurrent use of the English and French languages should be recognized and acted upon by the Institute. It was decided that the question might properly be placed on the programme for discussion at a future General Assembly. A debate ensued, in which the Canadian Delegate participated, in the course of which there were expressed opinions favourable to the translation of all the Institute Proceedings and publications, also to abandoning the metrical system for the "Bulletin of Statistics" and adopting expressions of area and capacity more readily understood in English speaking countries.

In addition to the practice of publishing monographs and Bulletins the Assembly approved the suggestion of the Bureau of Economic and Social Intelligence that there be published a Year Book of Economic and Social Institutions, also a dictionary of technical words used in their work. However, the publication of the Year Book and dictionary will have to wait the provision of adequate funds and, in the meantime, the requisite material will be collected.

International Institute of Agriculture (seen from the Pincio).

The Assembly dealt at length with the question of agricultural labour, which it was believed was to be discussed at the forthcoming Conference of the International Bureau of Labour at Geneva. There was a concensus of opinion strongly opposed to the fixing of an eight-hour day or even to the consideration of the claims of agricultural labour by delegates who formulated the demands of town labour and did not understand agricultural conditions. It was declared that the study of all that related to the conditions, economic, juridical and social, and the life of agricultural workers, should belong to the Institute and should be taken up on a more thorough scale than circumstances had hitherto permitted. The motion, asking that agricultural labour be withdrawn from the programme of the International Labour Bureau was finally dropped, and the Institute finally agreed that the report of the lengthy and interesting debate on the subject be specially published and sent to the Ministers of Agriculture and of the Interior of all the adhering countries.

In connection with the League of Nations the General Assembly expressed satisfaction that in the Treaty of Peace a plan had been included for co-operation among the nations and the realization of peace and international security, approved the attitude of the Permanent Committee concerning relations with the League of Nations and expressed the desire that the most friendly and cordial co-operation may be maintained between the two institutions. Although no motion was passed on the point it was almost the unanimous sense of the Assembly that while co-operation with the League is, from all points of view, desirable, still the Institute should maintain its full and entire autonomy.

The British Delegation in its own report of the proceedings while freely criticising the details of the organization and activities of the Institute, expressed the view that the experience of the war and the food prices have shed a very strong light upon the importance and even the necessity to all countries of some such organization as the Institute, that no one State is in the advantageous position in which the Institute stands, either as regards facilities for the collection of information or experience in handling it; that, as the discussions concerning the organization of a League of Nations have shown, if the International Institute did not exist it would now be necessary to create a body performing similar functions. The British Delegation urged that, difficult as the financial situation may be, Great Britain should not hang back but accept the obligation entailed in retaining the leading position she has always assumed in connection with the Institute. The British Delegates are persuaded that Great Britain will be fully repaid for her contribution by the use that will be made of the work done by the Institute.

CANADIAN CO-OPERATIVE WOOL GROWERS TO ESTABLISH THEIR OWN SELLING AGENCY ON THE ENGLISH MARKET.

Largely through the combined efforts of the Canadian Co-operative Wool Growers, Limited, a sheepmen's organization, and the Dominion Live Stock Branch, it is now generally recognized that the sheepmen of Canada are producing wool the equal of similar classes and grades grown elsewhere in the world. Gradually but surely a reputation has been established for our fleece wools on both the Canadian and American markets. This has, of course, been made possible to some extent by the greater attention being given to clips on the farms and in addition, to the grading system which has from year to year been improved upon. Canadian grades are now established, are standard in every particular and have been so satisfactory to our Canadian mills that they have led to increased orders each season from that source. The American market has always been an excellent outlet but at present it is closed temporarily owing to the heavy duty of 15 cents per pound enacted through the passing of the American Emergency Tariff Bill.

Last year, the sheepmen of Canada, through their own organization, made their first shipments of graded wool, some 130,000 pounds, to the English market, where it met with favorable comment. This has naturally led them to look toward that market as a possible outlet for a portion of their clip each year and with that end in view, Mr. G. E. O'Brien, General Manager of the Canadian Co-operative Wool Growers, Limited, sailed on June 21st for England. Mr. O'Brien carries with him a full line of samples of all classes and shades of our Canadian wool, Eastern Domestic, Western Domestic, and Western Range. These he expects to place before the English mill trade for the purpose of showing their attractiveness and suitability for the various lines of goods made by them.

A still more important feature of his visit to England, however, is that he contemplates the selection of a suitable firm of wool brokers to act as a selling agency for Canadian wools on the Bradford Wool Market. This marks another step forward and certainly one in the right direction in handling wool co-operatively. It will, of course, take some time to firmly establish a reputation in a comparatively new field. The wools will need to be tried out by the English mills and their shrinkage, etc., estimated in comparison with wools from other countries, before any great volume of trade can be forthcoming. Bradford is the main textile centre of the world, and is besides, the chief buying centre for Continental Europe. There is great possibility in this new departure on the part of the wool growers and in view of the agitation in this country for increased trade with the Motherland, the results will be watched with much interest by sheepmen all over the Dominion.

Canadian Society of Technical Agriculturists

Report of General Secretary for the Year Ending May 31, 1921. Read at the First Annual Convention, Winnipeg, June, 15, 1921.

This report, covering the first twelve months during which the C. S. T. A. has existed as an organized body, is prepared with a two-fold object in view: first, to outline briefly the work that has been done, and second to clearly indicate the three main periods into which the year has been divided.

At the close of the Organizing Convention on June 4, 1920, the Society had to immediately consider (1) the enrolment of new members (2) the raising of money by an appeal to Charter Members and (3) the completion of local organization work. The first two were made imperative by the financially crippled condition of the Society, and the last (provincial organization) was the machinery through which the member and prospective member could most readily and directly be reached. The finances of the Society were very seriously reduced by the loss of the promised grant of $2,500 from the Dominion Government.

The co-operation of the members of the Dominion Executive was at once sought and an appeal made to them to complete organization work in their respective provinces. New difficulties at once presented themselves. In most provinces the members were widely scattered, there was little hope of getting them together, and, in some instances, interest in the Society was rapidly waning, through ignorance concerning its objects, and concerning the proceedings of the Organizing Convention.

In order to relieve this condition to some extent, the General Secretary prepared and published a small booklet containing the constitution and by-laws as adopted, a statement from President Klinck, information regarding finances and other matters of interest, personnel of committees, and extracts from convention speeches. This booklet was printed gratis by the Industrial and Educational Pub. Co., and was mailed to members about July 20th; an appeal was at the same time made for financial assistance. Extra copies were mailed to prospective members in Ontario and to each member of the Dominion Executive to be used for propaganda purposes in the various provinces, and it was apparent that nothing could save the society from financial disaster except more complete organization and the enrolment of new members.

During the months of June, July and August branches were organized at Macdonald College (local) and in Prince Edward Island (provincial). The organization of the Quebec City (local) and the British Columbia (provincial) branches followed in September. On October 1st, only four branches were established, only 19 new members had joined since the organizing convention, and the Society was in debt to the amount of nearly eight hundred dollars. Few members realized the real crisis through which their Society was passing at that time.

The propaganda booklet was translated into French by Mr. J. N. Ponton, Second Vice-President of the Society, but could not be printed on account of funds. The complete report of the Convention had been revised and was available in manuscript form. No printed report appeared possible. The first period, a period of despondency, ended on September 30th, 1920.

Shortly after the Organizing Convention, negotiations had commenced with Mr. Harpell, Managing Director of the Industrial and Educational Publishing Company, in regard to the publication by that firm, of a technical agricultural monthly magazine as the official organ of the C. S. T. A. A meeting was held at Ste. Annes on June 28th, at which were present the President, Second Vice-President, Honorary Secretary and General Secretary of the C. S. T. A. and at which Mr. Harpell submitted details of the proposed arrangement. These were, briefly (1) that the publishers should own the magazine; (2) that one section, of scientific articles, should be prepared by the Society, and that no other articles or material should be printed which were not acceptable to the Dominion Executive of the Society; (3) that members of the C. S. T. A. should receive the magazine at one half its regular subscription price and (4) that publication should commence in January 1921. These arrangements were based on the supposition that the publishers would engage an editor who was not connected with the C. S. T. A. A modification was made during July, when it was suggested by the publishers that, with the approval of the Dominion Executive, the General Secretary should also assume the duties of Editor. This arrangement was finally made, and on October 1st, the General Secretary moved his headquarters from Ottawa to Gardenvale, P.Q. An effort was made to hold a meeting of the Dominion Executive on September 23rd, in order to discuss finances, magazine, and general matters of policy. There was not a quorum present, and the General Secretary was obliged to transact all business and solicit all counsel by mail.

October 1st, 1920 is the date on which the second period, or period of organization, commenced.

The French edition of the booklet was printed by the publishers early in October and used to good advantage in the Province of Quebec. The printing of the Convention report was also completed and this was mailed to members the latter part of December. No charge was made for the printing of either the booklet or the Convention report.

On October 28th, the General Secretary commenced a Dominion wide tour for the purpose of completing provincial and local organization work, and bringing to the direct attention of members, the purpose and merits of its official organ. The expense of this journey, as well as of numerous smaller and officially C. S. T. A. journeys, was completely borne by the publishers. No further reference will be made to their generosity in this report.

Between October 28th and the close of the calendar year the General Secretary attended seventeen meetings, as follows: Fredericton, October 30; Moncton, November 2; Charlottetown, November 4; Truro, November 9; London, November 17; Guelph, November 19; Ottawa, November 22 and 29; Quebec, December 3; Winnipeg, December 9; Regina, December 11; Vancouver, December 20; Victoria, December 23; Edmonton, December 27 and Saskatoon, December 31.

During this period, in addition to the four branches which were organized in July, August and September, eight more branches were established. On January 1st,

1921, there was at least one organized branch in every province, and with the exception of one branch to be formed in Western Ontario, organization work was completed. As an indication of the benefit of organization it is interesting to note that during the month of December when organization work was at its height, 41 new members joined the Society, as compared with 23 new members in the previous five months, and the sum of $250 was received in additional fees from 50 members, a total revenue of over $650 in a single month.

There is no need in this report to give details in regard to the organization of branches, the dates when they applied for authority to organize, when such authority was given, when their constitution and by-laws were received, and so on. Much of this information will be given by the Provincial representatives at this convention. The names of the officers of various branches are published regularly.

The third period of the C. S. T. A. year began on January 1st, 1921, and may be called the period of the official organ. Other work was done but the introduction and establishment of "Scientific Agriculture" was the main work performed. In connection with this work many difficulties have presented themselves and these should be solved by the deliberations of this Convention.

The introduction of a French section was permitted by the publishers, after strong requests had been made by the French speaking members. Mr. F. Letourneau was selected by the French members as their editor, at a meeting held in Quebec early in January.

After two unsuccessful attempts, the General Secretary on March 10th obtained a request from twenty members in Western Ontario, for authority to form a local branch. Officers were subsequently elected by mailed ballot, and the first official meeting was held at Guelph on May 17th. The organization of that Branch completed the Dominion-wide organization of the C. S. T. A.

Between January 1st and the date of this Convention the General Secretary attended business meetings of members as follows: Toronto, February 10th and March 10th; Ottawa, March 11th and April 29th; and Guelph, May 17.

The monthly increase in membership since the organizing Convention is as follows:

June 26; July 2; August 8; September 2; October 8; November 3; December 41; January 17; February 6; March 21; April 10; May 6. This is a total increase of 150, bringing the membership from 411 at the time of the organizing convention, to 561 on May 31st 1921. To be deducted from this total are 4 resignations which have been accepted by the membership committee. The actual number of members is therefore 557. These are distributed as follows:

Alberta 33; British Columbia 54; Manitoba 29; New Brunswick 23; Nova Scotia 24; Eastern Ontario 84; Western Ontario 86; P. E. I. 12; Quebec (English) 47; Quebec (French) 104; Saskatchewan 47; United States 11; British and Foreign 3.

Plans for the First Annual Convention were begun in March last; they have developed rapidly and in a most encouraging manner. Had it not been for the great assistance given by the officers and members of the Manitoba Branch, the provincial government officials and the staff of the Manitoba Agricultural College it would have been impossible for the Convention to be the success we now hope it will be. To these various officials the appreciation of the Society is due.

The official delegates, appointed by the various provinces are as follows:

Alberta, E. A. Howes, and J. M. Smith; British Columbia, W. H. Hicks, A. F. Barss and R. C. Treherne; Manitoba, T. J. Harrison and V. W. Jackson; New Brunswick, J. K. King; Nova Scotia, G. E. Sanders; Ontario, W. J. Bell, R. S. Hamer, J. E. Howitt, R. Innes, L. H. Newman, J. B. Reynolds; Prince Edward Island, J. A. Clark; Quebec, A. T. Charron, H. Barton, J. N. Ponton, L. C. Raymond, L. P. Roy, Jules Simard, Geo. Bouchard; Saskatchewan, J. G. Robertson, K. W. Gordon.

The ballots for the Dominion election were mailed from the office of the General Secretary on April 9th. 372 ballots were returned on or before April 30th and these were opened in Ottawa on May 2nd by Mr. Ronald Hooper, Honorary Secretary of the P. R. Society with L. H. Newman and the General Secretary present. The results were as follows:—

President, L. S. Klinck, Vancouver; First Vice-President, H. Barton, Macdonald College; Second Vice-President, John Bracken, Winnipeg; Honorary Secretary-Treasurer, L. H. Newman, Ottawa.

A financial statement is appended to this report. It will be presented in detail at the proper time by the Chairman of the Finance Committee. All that need be said here is that after a prolonged and often depressing struggle, the C. S. T. A. reached the close of its first year with a credit balance of $165.59.

A complete revised list of members is also appended.

The amount of correspondence written and received during the year has been voluminous. The mere fact that there are 557 members, 13 members on the Dominion Executive, 13 local branches and nine committees, will give an idea of the amount of inter-member correspondence necessary during an organization period. The splendid manner in which these various agencies have given their voluntary assistance is highly to be commended.

A tentative programme, embodying also a list of members, elected officers, delegates, provincial branches and the financial statement was mailed to members on May 31st.

Regular meetings of the Dominion Executive were held at Ottawa on June 4, 1920 and at Winnipeg on June 14, 1921.

The splendid voluntary assistance rendered by the members of the Dominion Executive and the local and provincial branch executives are greatly to be commended. They have done a very great deal of work, often at times when they were busy with other matters, and they have aided materially in the progress made during the year.

The future activities of the Society, and particularly those of the next twelve months, are intended to form the most important discussions at the present Convention. There can be no doubt that the C. S. T. A. can aid materially in the general agricultural advancement of Canada, but the Society must, in giving that assistance, always bear in mind the importance of aiding whenever possible, the individual member and the local branch. With a clearly defined programme for the coming year, and with the closest possible inter-communication between the branches, the members, the committees and the Dominion Executive, there is no apparent reason why the C. S. T. A. should not be so firmly established one year hence that its continuance will be unquestionable.

Apples in the Okanagan

An Investigation Regarding the Average Yields Of Leading Varieties.

By W. A. MIDDLETON,
Extension Assistant, Department of Horticulture,
University of British Columbia.

INTRODUCTION.

During the season of 1920 a study was made of the different operations entering into the cost of producing apples in the Okanagan Valley for the year 1919, and embodied in a report consisting of two parts: Part 1 dealing with Costs, and Part 2 dealing with Yields.

The investigation was conducted for the purpose of obtaining more definite and accurate knowledge of the cost of producing apples, and the average yields obtained from leading varieties.

This article consists of Part 2 which deals with the question of varieties and yields. The whole report is in the hands of the printer at the present time, and will be issued shortly in bulletin form.

The data contained in this report were obtained directly from growers who were able to give reliable information. The orchards from which the records were obtained are located in the fruit areas of Vernon, Kelowna, Summerland and Penticton.

Over eighty growers were interviewed, of which forty-two were able to give reliable figures for part of their cost. Many of the growers interviewed kept no records and hence were not in a position to furnish definite data. On the other hand, some who had not kept records were able to give reliable information which they had gained through their broad experience in orchard work. The data received from such growers tallied closely with those who had kept accounts.

The average size of the orchards studied was 16.2 acres. The average number of trees per acre was 74 and the average age of the trees 10 years.

AVERAGE YIELDS AND PRICES FOR LEADING VARIETIES.

There were in bearing in the Okanagan Valley in 1919 about 12,000 acres of apples 5 years of age and over. The apple crop in the Valley for the same year amounted to practically 1,750,000 boxes; giving an average yield per acre of approximately 146 boxes. Considering only some of the best commercial varieties grown in the average orchards, the yield in 1919 amounted to practically 280 boxes per acre, or an increase of 134 boxes per acre over the actual yield.

Reducing this to a tree basis, at 74 trees to the acre, this would mean an average actual yield of 1.97 boxes per tree for all varieties; 3.78 boxes per tree for the better varieties or an increase of 1.81 boxes per tree. On 12,000 acres this would mean an increase of 1,608,000 boxes of fruit. In other words, if the orchards in the Okanagan contained good commercial varieties the yield in 1919 would have amounted to approximately 3,358,000 boxes of apples. Figuring the average price paid to the grower in 1919 at $1.35 per box the extra money that would have been received by the Okanagan growers for that year would have amounted to about $2,170,800.

In securing data on yields only those varieties which had proven suitable for the Valley, and which have gained commercial importance were considered. Other varieties have been omitted from this report for various reasons. There are for instance varieties such as the Canada Baldwin, St. Lawrence and Ben Davis that have proved good yielders and suitable for the Okanagan, but for which the market is limited since they are low grade apples and do not bring top prices on the market when competing against such varieties as McIntosh, Rome Beauty or Delicious. Other varieties grown in the Valley such as Spitzenberg, Spy and Cox Orange are high grade apples and bring good prices, but are not suitable for Okanagan conditions and therefore have not to be considered in this report.

Yields were secured from 42 different orchards, 12 of which were located in the Vernon district; 9 in the Kelowna; 5 in Summerland and 16 in the Penticton district.

TABLE 1

Showing number of records on yields received for the Years 1913 to 1920.

Variety	1913	1914	1915	1916	1917	1918	1919	1920	Total
McIntosh . . .	2	5	7	7	12	16	29	2	80
Rome Beauty		1	1	1	2	3	7		15
Delicious . .				1	1	3	10	1	16
Wealthy . . .	1	2	4	4	7	7	15	1	41
Jonathan . . .	3	5	7	8	10	14	23	3	73
Yellow Newton		1	2	3	4	5	12	2	29
Wagner		2	2	3	5	8	15	1	36

It will be noted in the above table that the majority of records on yields were received for the year 1919. Since in general a heavy crop was produced in 1919 the total averages on yields may appear a little high. The main object, however, being to determine how the leading commercial varieties compare with each other in yields, this heavy 1919 crop will not materially affect the value of the comparison.

Table 2 shows the number of trees at different ages in which yields were received. It will be noted that the number of trees recorded from Rome Beauty and Delicious are small compared with the other varieties. Records taken from a larger number of trees might have affected the average to some extent.

A brief study of this table will show that in nearly all cases the 5 year old tree gives a higher average yield than the six year old.

This is accounted for by the alternate bearing of the fruit trees. To make a fair comparison on yields of different varieties it is obvious that yields from a number of years must be taken.

A brief study of Tables 5 and 6 will show that the McIntosh is the heaviest producing variety, but in Table 5 it will be noted that the Delicious has given a greater return per tree, even though the yield is lower, due to the extra price this apple brings on the market.

TABLE 2

Average Yield Per Tree 5 to 12 Years of Age.

McINTOSH

Age	No. Trees.	Total Yield in Pounds.	Average Yield in pounds.
5	5414	150080	27.7
6	4745	87774	18.5
7	7472	575912	77
8	4934	480455	97
9	3166	423556	133.8
10	2966	593054	199.9
11	1256	356306	283.6
12	1092	493045	451.5

DELICIOUS.

5	850	18092	21.28
6	697	14720	21.1
7	974	65214	66.9
8	370	24600	66.5
9	310	38745	124.9
10	375	56399	150.4

11 and 12. No Records.

WEALTHY.

5	4346	85500	19.9
6	2499	31680	12.6
7	5449	358614	65.9
8	2870	185050	64.5
9	3402	473762	139.2
10	3189	372850	116.9
11	675	144488	214
12	325	105680	325

ROME BEAUTY.

5	....	......	....
6	100	3600	36
7	162	10074	62.1
8	180	8274	45.9
9	334	44520	133.3
10	243	49940	205.5
11	243	53800	221.4
12	88	17560	199.5

JONATHAN

5	13982	169000	12
6	12099	267204	22
7	15712	1296357	82.3
8	6171	405229	58.6
9	7372	727078	98.6
10	7287	572514	78.5
11	4062	505560	124.4
12	1850	378051	204.3

YELLOW NEWTON.

5	838	Nil	Nil
6	1022	14720	14.4
7	1298	18892	14.5
8	1122	27960	24.9
9	640	81725	127.7
10	358	36392	101.6
11	193	25565	132.4
12	195	42920	220

WAGENER.

Age	No. Trees.	Total Yield in Pounds.	Average Yield in pounds.
5	2936	84960	28.9
6	1140	12570	11
7	4280	159848	37.3
8	3485	195049	55.9
9	2176	117640	54.9
10	3086	238617	77.3
11	2144	213960	99.3
12	1270	274750	216.3

TABLE 3.

Average yearly yield per Tree, Age 5 to 10 years, 6 year period.

Variety.	Yield in Pounds.	Yield in Boxes (40 Pounds).
McIntosh	92·4	2·31
Rome Beauty	80·5	2·01
Delicious	75·18	1·88
Wealthy	69·8	1·75
Jonathan	58·7	1·47
Yellow Newton	47·2	1·18
Wagener	44·2	1·10

TABLE 4.

Average Yearly Yield per Tree, Age 6 to 12 years, 7 year period:

Variety.	Yield in Pounds.	Yield in Boxes (40 Pounds).
McIntosh	180·2	4·5
Wealthy	134·1	3·35
Rome Beauty	129·1	3·2
Jonathan	95·5	2·4
Yellow Newton	90·78	2·27
Wagener	78·9	1·97

No records were received on Delicious trees 11 and 12 years of age, consequently this variety is not included in Table 4.

TABLE 5.

Variety	Average Yield per tree 5 to 10 years in Boxes	Average Price per box 1919 No. 1 & 2	Average Returns per year
Delicious	1.88	$1.85	$3.48
McIntosh	2.31	1.46	3.37
Rome Beauty	2.01	1.37	2.75
Wealthy	1.75	1.36	2.38
Jonathan	1.47	1.34	1.96
Yellow Newton	1.18	1.39	1.54
Wagener	1.10	1.30	1.43

TABLE 6.

Variety	Average Yield per tree 6 to 12 years in Boxes	Average Price per box 1919 No. 1 & 2	Average Returns per year
McIntosh	4.5	1.46	6.57
Wealthy	3.35	1.36	4.54
Rome Beauty	3.2	1.37	4.38
Jonathan	2.41	1.34	3.22
Yellow Newton	2.27	1.39	3.16
Wagener	1.97	1.30	2.56

VARIETIES.

The planting of unsuitable varieties has cost growers in the Okanagan thousands of dollars. This mistake, however, could hardly have been avoided, as the pioneer growers were naturally inclined to plant those varieties which had proven successful in the Old Country, Eastern Canada or the United States, thinking they would be equally well or better in the Okanagan. Results, however, have shown that a good many varieties that have been planted have not proven suitable to Okanagan conditions. There have been a few instances, also, where nurserymen have shipped trees not true to name or have substituted wrong varieties with the result that the grower found, after his trees began to bear, that instead of McIntosh which he had ordered, he had Baldwins or some other unsuitable variety.

More attention is now being paid to the successful commercial varieties, so that the number of undesirable sorts is gradually decreasing. Those who have unsuitable varieties should seriously and intelligently consider if it would be to their advantage to top work their trees to good varieties, or to pull out their unprofitable trees and plant a young orchard, or if the fault lies with the soil and location, to grow some other crop which would be reasonably sure to give better returns than the orchard.

For a good commercial orchard the individual grower should guard against the planting of too many varieties, and on the other hand, the grower may make the mistake of confining his plantings to but one or two varieties. A safe rule to follow would be to plant not less than three or not more than six different varieties. Four will be sufficient in some cases. By choosing the varieties that ripen at different seasons, one may extend the picking period which is an important factor to consider in harvesting a fruit crop.

Varieties Recommended.

While studying orchard costs and yields an effort was made to determine which varieties were most suitable for the Okanagan both from the grower's and shipper's point of view. Only those varieties which have proven suitable for the valley and have been well received on the market, were considered. It is not unlikely that other varieties will be recommended later, but as yet they have not been sufficiently tested out to warrant approval for commercial planting at this time.

In recommending commercial varieties for planting in the Okanagan the valley has been separated into two divisions. The northern half includes Kelowna and the fruit districts north. The southern half includes the fruit districts south of Kelowna.

Division 1.—Kelowna and north: McIntosh, Delicious, Rome Beauty, Wealthy, and Duchess.

Division 2.—South of Kelowna: Delicious, Rome Beauty, Winesap, Stayman, Jonathan and Gravenstein.

McIntosh.—Undoubtedly the McIntosh is one of the leading varieties grown in the Okanagan. It appears to be more particularly adapted however, to the northern end of the valley, bearing more regularly each year than in the southern districts. The shipping quality of the northern grown McIntosh also surpasses that of those grown in the south end of the valley.

The McIntosh comes into bearing early, is a fast growing tree, and a heavy yielder, standing head and shoulders above other varieties in this respect.

The McIntosh will largely thin its fruit on the tree and still produce a heavy crop of No. 1 apples. Nevertheless, thinning should be practised for best results.

One of the main objections to this variety is that it has a comparatively short harvest season and will drop easily when it has reached maturity.

Many growers are under the impression that the planting of the McIntosh has been, or will soon be, overdone in British Columbia. It is a variety that must be handled and consumed in a comparatively short season, practically two months, October and November, although with proper care one may enjoy the McIntosh until the New Year and even later. Also this variety is now being planted largely in the East. To offset these facts, on the other hand, one must remember that the McIntosh reaches its perfection in British Columbia and the province should be able to more than hold its own with this variety.

Delicious.—Much attention has been paid to the Delicious during recent years, and prices received for this variety have topped those received for all other varieties except on the Old Country market.

The Delicious has proven very well suited for the Okanagan and as shown in Table 5 has given a greater return per tree to the grower than any other variety. The fruit is evenly distributed over the tree and heavy thinning is not necessary as a rule.

The Delicious may be considered the leading late variety grown in the Okanagan.

Rome Beauty.—This variety has gained in popularity in late years. It is now considered one of the best baking apples on the market.

The Rome Beauty has proven to be well adapted for Okanagan conditions and will be favourably considered in future plantings. More data is required to strike what would be considered a good average yield for this variety, although it is not likely that further records would alter materially the yield as shown in Tables 3 and 4.

Wealthy.—The Wealthy is a hardy tree and does exceptionally well in the Okanagan, especially in the Northern section of the Valley.

It has a tendency towards alternate bearing, over bearing one year, and producing a light crop the following year. During heavy bearing years, considerable thinning must be practised, as the apples will bunch and will not thin themselves so readily as do the McIntosh.

Duchess.—The Duchess is the leading variety grown, in the Northern end of the Okanagan, its season being just ahead of the Wealthy. Unfortunately, sufficient records were not received to give a fair average on yield.

This variety, like the Wealthy, has a tendency to bear fruit in bunches and thinning must be practised.

The Duchess is a comparatively small growing tree and should be considered chiefly as a filler.

Winesap.—Extensive planting of the Winesap will probably be made in the Southern end on the Okanagan especially in the Osoyoos and Similkameen sections. It does fairly well in the Penticton district, but further North than this the fruit does not on the average develop the desired size.

The market demand for the Winesap is good and this variety will undoubtedly reach commercial importance in the future in fruit districts south of Penticon.

The records so far received on yields for this variety are not sufficient to strike a reliable average.

Stayman.—This variety has not yet reached commercial importance in the Valley. It appears however, to be well adapted for the Summerland and Penticton districts, and will undoubtedly be given favourable consideration in future plantings.

The Stayman does not equal its parent the Winesap in color, although in the South end of the Okanagan it colors well and makes quite an attractive apple when packed, and is in good demand on the market.

The tree comes into bearing young and is a reliable cropper. Due to the limited plantings of this variety, sufficient records were not received on yields to obtain a good average.

Gravenstein.—More attention is being paid to the Gravenstein in the Summerland and Penticton sections, and although no yield records were obtained it would appear that the Gravenstein may become one of the leading Fall apples in the sections above mentioned and possibly in the Osoyoos country as well.

Due to its high quality, the Gravenstein is in good demand on the market, and will generally bring a comparatively high price. The planting of this variety will be limited for some time until it is more thoroughly tested out.

Jonathan.—This is one of the leading varieties now grown in the Okanagan. It is better suited for the Southern end of the valley and future plantings will be chiefly confined to the Osoyoos and Similkameen districts, and there only as a filler. The Jonathan has not proven a very hardy tree and is subject to Winter injury except in favored localities. This variety is well received on the market.

Wagener.—As shown in tables 3 and 4, the Wagener is not a heavy yielder; this of course is to be expected as the Wagener is a small growing tree.

The tree is not particularly hardy and during extreme cold weather it is subject to winter injury, but fortunately appears to be able to make a quick recovery. In favored locations the Wagener does well, but future plantings will be limited as it can only be considered as a filler and is not a strongly favored apple on the market.

Yellow Newton.

The market demand for the Newton is generally good especially in the Old Country, but this variety has not proven a heavy yielder as will be noted in Tables 3 and 4, and is not recommended for future planting.

Experiments in the Control of Rhizoctonia or Black Scurf of Potatoes

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Rhizoctonia or Black Scurf is very frequently met with in Ontario and in seasons of excessive rain-fall often results in a noticeable reduction of the crop. Tubers are frequently seen with what appear to be lumps of hardened soil adhering to them. These when wet are black in color and they vary in size from mere specks to one-quarter of an inch in diameter. Sometimes they are very numerous and so noticeable as to render the tubers unsightly, and hence, not readily saleable. These little black lumps are known as sclerotia and consist of compact masses of resting fungus threads (mycelium.) The flesh of the potato beneath is not injured to any extent by them. If, however, tubers with these little black lumps adhering to them are planted, the fungus may spread to developing sprouts and kill them before they get above the ground, this being one cause of misses in the rows. Later in the season several other symptoms may develop. Young shoots may wither and die and if these are pulled up and examined, there will be found at the base of the stem brown, dead, areas often encircling it. Sometimes at the base of the stem of affected plants a cluster of small tubers may be found and frequently small greenish potatoes are seen on the stem above the ground. Such aerial tubers are very characteristic of the disease, but may result from other causes, such as injury to the stem by cultivation.

The chief means by which the fungus is spread is through planting potatoes with sclerotia adhering to them. The same fungus attacks many cultivated plants besides potatoes and frequently causes the damping-off of seedlings.

Since the fungus lives on so many different plants and appears to be native to many soils it is impossible to "starve it out" by a rotation of crops and there has been very great difficulty in the past in preventing this disease. Experiments have been conducted here at the Ontario Agricultural College for the past two years with the object of determining if the amount of Black Scurf or Rhizoctonia can be reduced by selecting seed tubers free from the characteristic little black lumps, or sclerotia, and what strength of corrosive sublimate and what time of immersion gives the best control of this disease.

The results for 1920 are very striking. They may be summarized as follows: Selecting tubers free from sclerotia and planting them without any treatment was found to reduce the amount of badly disfigured tubers from 98·9 to 82 per cent. Immersing seed potatoes covered with sclerotia in corrosive sublimate solution, one part by weight to 2,000 of water for two hours reduced the disfigured tubers to 21 per cent. Immersing similar seed in corrosive sublimate, strength 1-1000 for two hours reduced the disfigured tubers to 14 per cent; corrosive sublimate 1-2000 for three hours reduced the disfigured tubers to 16 per cent; corrosive sublimate 1-1200 for one hour reduced the disfigured tubers to 18·8 per cent; and corrosive sublimate 1-500 for two hours gave perfect control, there being no badly disfigured tubers obtained from seed which was treated with corrosive sublimate of this strength.

The results of two years experiments show very clearly the effectiveness of corrosive sublimate in the control of this disease. These experiments are being continued with the object of determining what strength of solution to recommend to the farmers of Ontario in order that they can prevent this disease effectively, with the least labor, and the least cost.

Nodule Bacteria of Leguminous Plants

By F. Lohnis, *Soil Biologist, Bureau of Plant Industry, United States Department of Agriculture,* and Roy Hansen, *Professor of Soils, University of Saskatchewan, Saskatoon, Sask.*[1]

INTRODUCTION.

Despite the fact that the nodule bacteria of the leguminous plants have been made the subject of numerous publications, it is not to be disputed that their true morphological and physiological character, as well as their correct systematic position, are by no means sufficiently known. This is especially clearly demonstrated by the fact that they are still proclaimed by several writers to be the representatives of a special genus Rhizobium, once established by A. B. Frank as the result of rather inadequate studies upon this subject. In the new classification of bacteria, adopted by the Society of American Bacteriologists, the nodule bacteria again are widely separated from closely related species, and the error concerning the so-called genus Rhizobium has been revived once more.

Comparative investigations upon the symbiotic and the nonsymbiotic nitrogen-fixing bacteria of the soil, published in 1905 by the senior author, have proved conclusively that the nodule bacteria are not representatives of a special genus Rhizobium, but that they are closely related to *Bacillus radiobacter* Beijerinck and further to *B. lactis viscosum* Adametz, *B. pneumoniae* Friedlander, and *B. aerogenes* Escherich. The last three organisms are immotile, while the first one is motile; but here again the very close relationship between the immotile *B, aerogenes* and the motile *B. coli* has to be kept in mind. In fact, there can be easily isolated from every soil numerous varieties of *B. radiobacter*, which lead gradually up to *B. coli*, acquiring the power of fermentation and that type of growth on solid substrates which is characteristic of the last-named species. It has been pointed out in detail that all species mentioned above differ only gradually, not principally, in their physiological and morphological qualities, and especially that those branched or otherwise changed cell forms which are frequent in the root nodules are equally common with all members of this group of capsule bacteria, if these are tested adequately.[2] The ability to fix the atmospheric nitrogen was shown to be common in this group of organisms.

Bacillus radiobacter was found to be peritrichic, and the same paper also indicated (12, *p.* 592, *footnote*)[1] that in all probability *B. radicicola* has the same kind of flagellation. But no faultless preparates were obtained at that time.

In the same year, 1905, G. T. Moore wrote concerning the nodule bacteria (14, p. 26):

"There does not seem to be any necessity for creating a new group to include these organisms, as has been done by Frank, under the name of Rhizobium, for although there is a certain amount of polymorphism, it is no greater than frequently occurs in the bacteria."

With regard to the flagellation, however, Moore himself evidently made no special studies, and, accepting Beijerinck's statement that the "swarming bodies" (gonidia) of *Bacillus radicicola* are monotrichic as being valid for the bacteria, too, he proposed to call the nodule bacteria *Pseudomonas radicicola.* Numerous authors have followed this suggestion, and experiments made by Harrison and Barlow (8) apparently confirmed the view that the flagellation of these organisms is indeed monotrichic.

However, these experiments are, in fact, not convincing, as has been emphasized especially by Kellerman (9). This author and also G. de Rossi (16, 17), Zipfel (19), and Prucha (15) secured results all of which demonstrated more or less clearly that the senior author's assumption was correct: *Bacillus radicicola* is peritrichic; it is no *"Pseudomonas."*

But this seemed again to be contradicted by certain results obtained by the junior author while working with the late T. J. Burrill (6). Numerous tests made with the bacteria isolated from cowpea, soybean, Japan clover and other plants showed clearly and invariably monotrichic flagellation, and, therefore, the designation *Pseudomonas radicicola* was restored once more. Additional results, however, indicated that there are other features which differentiate the bacteria of the cowpea-soybean group from those living in the roots of clover, alfalfa, pea, and vetch. Especially the slime production and the speed of growth appeared to be different, and the organisms studied were arranged into two groups, "slow growers" and "fast growers". Both, however, were supposed to be merely varieties of *P. radicicola.*

This point remained to be investigated more thoroughly. In addition, another "fast grower" presented itself for detailed study, which quite regularly appeared on thickly sown plates of the "slow growing" groups, and which, indeed, has been mistaken by several investigators as the true nodule organism of cowpea, soybean, Japan clover, etc. Repeatedly such cultures were sent to and tested by the junior author. They were all unable to produce nodules.

The data given on the following pages make it evident that this "fast grower" is *Bacillus radiobacter*, which plays in this case, also, a very interesting rôle. As this same species undoubtedly takes part in many processes occurring in soil and in water, it was thought useful to give another more detailed description of it, especially because, despite its ubiquity, *B. radiobacter* is much too little known. In addition

* Reprinted from Journal of Agricultural Research, Vol XX, No. 7, Jan. 3, 1921.

[1] Most of the experiments discussed in this paper were made in the summer of 1919 at the University of Illinois, where at that time the junior author held the position of Associate in Soil Biology. The protographs accompanying the paper were made by Mr. F. L. Goll, of the Bureau of Plant Industry, United States Department of Agriculture.

[2] It is not superfluous to emphasize once more that persistence in calling these forms "bacteroids" is by no means to be recommended. They are true bacteria, not foreign bodies looking like bacteria, as Franks' pupil Brunchorst erroneously believed. To speak of a "bacteroid" growth of bacteria is no less absurd than it would be to speak of a "fungoid" growth of fungi.

to the rather short description given by Beijerinck, only the more complete one published by the senior author in 1905 exists thus far. On account of its great similarity to *B. radicicola*, *B. radiobacter* should be very well known to all bacteriologists working with the nodule bacteria in order to avoid mistakes which may otherwise not be discovered until only negative results are obtained in the inoculation tests.

Concerning the flagellation of the nodule bacteria three statements have been published more recently which also will have to be discussed presently. According to J. K. Wilson (18) the soybean bacteria are peritrichous; Barthel (2) declared lupine and alfalfa bacteria to be lophotrichous; Fred and Davenport (7) found the alfalfa organism peritrichous, but they found the lupine bacteria characterized by having one, rarely two, flagella.

EXPERIMENTAL RESULTS.

The following strains of nodule bacteria were studied after having been tested with positive results in regard to their ability to produce nodules on the host plants from which they were isolated.

1. Cowpea.
2. Peanut.
3. Japan Clover.
4. Beggar Weed.
5. Soybean.
6. Red clover.
7. Sweet clover.
8. Vetch.
9. Strophostyles.

There were also included in our investigations two strains isolated from:

10. Black locust.
11. Lupine.

No positive inoculation test could be made on black locust. The lupine culture was kindly furnished by Dr. E. B. Fred, of the University of Wisconsin, who had tried it with positive results on this plant. Our tests were equally successful.

Two noninfectious "fast growing" cultures isolated from legume nodules and identified as *Bacillus radiobacter* were studied in comparison with six Radiobacter strains which originated from soil and which were kept in the senior author's collection since the years given in parentheses.

12. Fast grower from cowpea.
13. Fast grower from soybean.
14. *Bacillus radiobacter* from soil (1904).
15. Same (1907).
16. *Bacillus radiobacter* from soil (1908).
17. Same (1908).
18. Same (1908).
19. Same (1916).

No. 14 is the strain which in 1904 had been acknowledged by Prof. Beijerinck as being identical with his *Bacillus radiobacter* and which was used by the senior author for the original description published in 1905 (12).

The results of our investigations leave no doubt that the earlier findings of the junior author were correct so far as the polar flagellation and the peculiar morphological and cultural features of the cowpea-soybean organisms are concerned. On the other hand, it could now be ascertained with equal certainty that the bacteria producing nodules on clover, alfalfa, vetch, and other plants originally cultivated in Europe are all peritrichic and exhibit all the characteristics of *Bacillus radicicola*, as described by Beijerinck and other authors.

Those findings which were obtained most frequently and which may be considered as being typical for the two groups of nodule bacteria are compiled in Table I, together with analogous data pertaining to *Bacillus radiobacter*. Photographs of the most characteristic details are reproduced on Plates 68 and 69.

When grown from the root nodule on Harrison and Barlow's ash agar, mannite agar, or similar agar of low nitrogen content, the two groups of nodule bacteria are best characterized and differentiated by the very slow growth of colonies in the cowpea-soybean group and the comparatively quick growth of those of *Bacillus radicicola*. Frequently, but not always, the development of *B. radiobacter* is still somewhat more rapid than that of *B. radicicola;* in the macroscopical as well as in the microscopical aspects, however, the colonies of these two species on such media are so very much alike that it is almost impossible to distinguish them with certainty. Both, when developing on the surface, are perfectly round, drop-like, soft, watery or slimy, glistening, transparent. Often a whitish center or whitish streaks become visible within the more transparent mass, especially if the surface colony is the outgrowth of an imbedded colony. Sometimes it appears as if this whitish center were regularly to be seen only with certain strains of Radicicola and Radiobacter. This is not the case, however. Its presence or absence is erratic and cannot be used for differentiation. The imbedded colonies are always small, white, opaque, mostly lentiform, less frequently circular. Under the microscope the surface colonies present themselves as sharp-edged disks, pure white at the outside with yellow-grayish granulation in the center. In a few cases a radiate structure becomes visible. The colonies of the cowpea-soybean group appear macroscopically, as well as microscopically like young colonies of the Radicicola type. The presence of Radiobacter colonies on the plate stimulates their growth markedly.

In cell morphology there is again a more pronounced relationship between Radiobacter and Radicicola than between the nodule bacteria of the clover-vetch group on the one side and of the cowpea-soybean group on the other. This holds true with the regular rod forms as well as with the very pleomorphic, curved, swollen, branched, or otherwise changed types of growth characteristic of these groups. The photographs on Plate 68, D-L, represent the pictures we have seen most frequently, but they do not pretend to give a complete illustration of the wide pleomorphism of these organisms. Before their complete life history can be given much additional material will have to be collected, especially with regard to the form of gonidangia, regenerative bodies, and the various cells developing from the symplastic stage. At present we intend only to bring out as clearly as possible those points which are important for a correct differentiation and diagnosis. As far as one may judge from the microscopic appearance, it is the inclination of *Bacillus radiobacter* to form stars which is most characteristic (Pl. 68, L), and this was used, therefore, by Beijerinck for its denomination. With *B. radicicola* the frequent occurrence of the clear-cut, compact Y forms is the most conspicuous feature (Pl. 68, H); whereas the bacteria of the cowpea-soybean group present themselves in most cases, when stained with aqueous aniline dyes in the usual manner, as short or long, unstained sheaths with one or more darkly stained granules (Pl. 68, J). Of course Y forms, as well as unstained sheaths with darkly stained gonidia, can be observed not infrequently with the other organisms, too, and the star forma-

Table I.—Development of cowpea-soybean bacteria, Bacillus radicicola (from clover, vetch, etc.), and B. radiobacter

Substrates.	Cowpea-soybean bacteria.	*B. radicicola* (from clover, vetch, etc.)	*B. radiobacter.*
Mannite-nitrate agar slant	MACROSCOPIC EXAMINATION.—Raised whitish to porcelain white, glossy layer. MICROSCOPIC EXAMINATION.—After 3 days slender rods, sometimes curved; after 7 to 10 days unstained, irregular sheaths, with 1 to 4, most frequently 2, darkly stained granules; after 2 to 3 weeks many small globules, ovals, and short rods outside of the unstained sheaths also small globular regenerative bodies.	MACROSCOPIC EXAMINATION.—Slimy, transparent growth, with or without whitish streaks. MICROSCOPIC EXAMINATION.—Small ovals and short rods, producing after 1 to 2 weeks gonidia and small globular regenerative bodies. Also unstained slime threads with dark granules and large globular, or oval gonidangia; irregular pale forms from symplasm.	MACROSCOPIC EXAMINATION.—Thick, slimy transparent layer, with whitish streaks. MICROSCOPIC EXAMINATION.—After 7 days small ovals and short rods, imbedded in slime; after 14 days some rods with thick unstained capsules forming symplasm; after 3 to 4 weeks normal cells, stars, and large globules and clubs from symplasm.
Beef agar slant.	MACROSCOPIC EXAMINATION.—Fairly good whitish growth. MICROSCOPIC EXAMINATION.—After 3 days weakly stained, irregular, thin, short rods; after 7 to 10 days irregular rods, producing gonidia and globular regenerative bodies, which may multiply as such; after 2 to 3 weeks very variable appearance, rather long slender rods, often branched, or club-shaped, globular regenerative bodies, also unstained, irregular sheaths with dark granules, and large globular gonidangia.	MACROSCOPIC EXAMINATION.—Meager, flat, grayish growth. MICROSCOPIC EXAMINATION.—Mostly small ovals and short rods, the latter sometimes curved, budding and branching; later also large rods, and large globular, oval, or club-shaped gonidangia.	MACROSCOPIC EXAMINATION.—Flat, whitish slimy layer, thick sediment below. MICROSCOPIC EXAMINATION.—As on mannite-nitrate agar.
Beef gelatin stab	MACROSCOPIC EXAMINATION.— Very small, gray, nonliquefying disk on the surface, hardly any growth in the stab. MICROSCOPIC EXAMINATION.—Thin rods, sometimes branched or swollen, producing gonidia and smal globular regenerative bodies; in old cultures gonidia and regenerative bodies frequently predominating.	MACROSCOPIC EXAMINATION.—Small gray nonliquefying disk on surface, very little growth in stab. MICROSCOPIC EXAMINATION.—Small ovals and short rods, gonidia, and small globular regenerative bodies.	MACROSCOPIC EXAMINATION.–Grayish, flat, round, nonliquefying surface growth, little growth in stab; after 2 to 4 weeks gelatine sometimes brown on top. MICROSCOPIC EXAMINATION.—Typical ovalsand shortrods, these sometimes curved or branched, also unstained slime threads with dark granules, later symplasm with stars.
Beef broth.	MACROSCOPIC EXAMINATION.—Broth at first clear, with little sediment later (after about 2 weeks) slightly turbid. MICROSCOPIC EXAMINATION.—After 3 days slender rods, sometimes curved; after 2 weeks granular rods producing gonidia, also budding and branching, small globular regenerative bodies, and symplasm; after 3 to 4 weeks very irregular forms, branching, swelling.	MACROSCOPIC EXAMINATION.—Broth either clear or very slightly turbid, little whitish sediment. MICROSCOPIC EXAMINATION.—Small ovals and short rods, budding and branching, occasionally threads; after 1 to 2 weeks many gonidia and small, globular regenerative bodies	MACROSCOPIC EXAMINATION.—Broth turbid, white ring, whitish film,much whitish sediment. MICROSCOPIC EXAMINATION.—Small ovals and short rods, budding and branching; later gonidia, globular regenerative bodies, threads, and fine stars from symplasm.
Milk.	MACROSCOPIC EXAMINATION.—During the first weeks no change visible, later slow digestion, no clear serum zone. MICROSCOPIC EXAMINATION.—Mostly small globules and ovals, few short, slender rods.	MACROSCOPIC EXAMINATION.—After 1 to 4 weeks clear serum zone on top, 2 to 5 mm. thick; milk below nearly unchanged, very fine flocculation. MICROSCOPIC EXAMINATION.—Small ovals and rods, later also granular threads and symplasm.	MACROSCOPIC EXAMINATION.— First slime ring and serum zone on top later whole milk turning brown. MICROSCOPIC EXAMINATION.—After 7 days typical ovals and rods; later small and large cells from symplasm.
Potato	MACROSCOPIC EXAMINATION.—Very meager, transparent, thin layer. MICROSCOPIC EXAMINATION.—After 7 days slender rods, sometimes branched, or with terminal swelling; after 4 weeks small globules and ovals, irregular rods (frequently branched), globular regenerative bodies, and symplasm with very variable new development.	MACROSCOPIC EXAMINATION.—Meager, transparent, slimy growth. MICROSCOPIC EXAMINATION.—Small slender rods, budding and branching, some ovals, globular regenerative bodies; later gonidia predominant.	MACROSCOPIC EXAMINATION.—First gray later coli-brown slimy layer, potato turns frequently gray. MICROSCOPIC EXAMINATION.— First small ovals and short rods, budding and branching, later also large oval and globular gonidangia and symplasm with stars.

tion is by no means solely to be found with Radiobacter; but we feel sure that those pictures, as shown on Plate 68, G-L, will be found most valuable for diagnostical purposes.

The flagellation is the same with Radiobacter (Plate 68, C) and Radicicola (Plate 68, B), while the bacteria of the cowpea-soybean group are characterized by one coarse, fairly straight polar flagellum (Pl. 68, A). Just before fission one cilium may be seen at each end; as a rare exception one tuft of polar flagella was observed occasionally. Frequently a darkly stained body becomes visible within the rod just at that point where the flagellum springs forth, which may be considered to be a flagellated, not yet liberated, gonidium, such as can be seen occasionally with many other bacteria, especially with *Bacillus radicicola*, too. When liberated this becomes the monotrichic small "swarming body" described by Beijerinck in 1888 (4).

The growth on mannite-nitrate agar, as well as on beef agar slants, as described in Table I, is quite characteristic, and after the eyes have been sufficiently trained, one seldom makes a mistake in guessing the group to which a culture presented for inspection may belong. But it must be admitted that occasionally and temporarily a strain of the cowpea-soybean group can show the flat, transparent growth characteristic of Radicicola, whereas it is a very rare occurrence that a member of the last-named group simulates the former one. The growth of Radiobacter is always very typical, except when a very weak strain is encountered, which does not frequently occur within this group. Plate 69, A, demonstrates the characteristic differences noticeable on mannite-nitrate agar as clearly as they can be shown in a photographic reproduction.[1]

Cultures on beef gelatine and in beef broth differentiate clearly Radiobacter and nodule bacteria, while, as stated in Table I, the two groups of nodule organisms grow very much alike on these substrates. Microscopic tests, however, made from gelatine and broth furnish, in most cases, especially characteristic pictures, provided that the growth has not been altogether too poor to get a satisfactory preparate.

The growth in milk and on potato, as described in Table I and illustrated on Plate 69, is very characteristic and can be used to great advantage for diagnosis. It is not to be denied that with old stock cultures atypical results may sometimes be obtained in this direction also. Especially cultures rich in or entirely made up of the globular regenerative bodies, which are produced by these as well as by all other bacteria, furnish whitish, yellowish, or only slightly brownish growth on potato in the case of *Bacillus radiobacter* and *B. radicicola*. But we have never seen such atypical growth with new isolations. Here the coli-brown color of the potato cultures separates Radiobacter sharply from the nodule bacteria, and these in turn are equally sharply to be distinguished by the behavior of their milk cultures. It is true that sometimes milk cultures of the *B. radicicola* group also leave the milk unchanged, but the microscopic test of such abnormal cases probably will always show, as it did in the cases studied by us, that the abnormality was simply caused by the fact that the bacteria which were inoculated did not multiply at all. Furthermore, no alteration may be seen if milk is used which has been kept for a long time and has been concentrated by evaporation of part of its water.

To determine on a larger scale whether this different behavior of the two groups of nodule bacteria, when grown in milk, can be correctly accepted as of real diagnostic value, all cultures of nodule bacteria at our disposal were tested simultaneously with the following results:

Milk was changed as typical for Bacillus Radicicola by the following cultures:	*Milk was left unchanged by the following cultures:*
5 from red clover.	10 from cowpea.
4 from sweet clover.	8 from soybean.
6 from navy bean	5 from peanut.
1 from vetch.	4 from Japan clover.
2 from lupine.	2 from beggar weed.
3 from black locust.	2 from *Cassia chamaecrista.*
3 from Amorpha.	
2 from Strophostyles.	

If kept for longer than four weeks milk cultures of the cowpea-soybean organisms usually become more or less transparent on account of partial decomposition of the casein; but they never show the perfectly clear zone characteristic of the other group.

The bacteria were also tested on other media besides the standard substrates, of which sterilized soil, moistened with 0.5 per cent mannite solution, mannite-nitrate solution as used for studying the life cycle of Azotobacter, tap water plus 0.5 per cent beef broth, and 2 per cent salt agar furnished the most satisfactory results, especially with regard to a more complete knowledge of the cell morphology of the organisms. For diagnostic purposes, however, these substrates are of minor importance, as they do not bring out anything which is not already to be seen on the standard media. Nevertheless, it should be pointed out that cultures of the nodule bacteria in soil are to be recommended for two reasons. First, they are useful in keeping the organisms in a normal state of virility for a long time, and, in the second place, they demonstrate very clearly, when studied microscopically, that it is erroneous to believe — though numerous authors have promoted such hypotheses — that the nodule bacteria behave very differently in soil and could, therefore, not be isolated in their typical form from their natural habitat. Our results are in complete agreement with those recently obtained by Barthel (3) concerning the growth of bacteria in sterilized soil.

Tap water containing 0.5 per cent beef broth gave also very good development and proved repeatedly helpful in reviving old, weakened strains which refused to grow on solid substrates.

DISCUSSION

Our experimental results leave no doubt that the nodule bacteria of the leguminous plants are to be divided at least into two distinct groups, differing

[1] As was the case with Azotobacter, for which the mannite-nitrate agar was first used (13, p. 686), so also the nodule bacteria and Bacillus radiobacter grew very rapidly on this substrate. Allen (1, p. 33) asserted recently that he could not get any growth of Azotobacter on a dextrose agar, which he erroneously called "Lohnis and Smith's medium." But not even the formula used by us has been quoted correctly by Allen, and it is, of course quite obvious that on account of the alterations made by Allen his agar must indeed have been quite unsuitable.

morphologically as well as culturally. It is equally beyond dispute that these differences are so marked and constant that one might be inclined to establish the nodule organism of the cowpea-soybean group as a new species. On account of its behavior in the inoculation test O. Kirchner has considered the soybean organism a distinct species, which he named in 1895 *Rhizobacterium japonicum* (10). According to the rules of priority, this species name would have to be given preference, despite the fact that different behavior in the inoculation test generally cannot be accepted as a distinguishing mark of such quality as to validate the creation of a new species. The generic name Rhizobacterium, used by Kirchner, is, of course, equally as untenable as the generic name Rhizobium. According to the two most frequently used modes of classifying the bacteria, one might name the cephalotrichic non-sporulating rod of the cowpea-soybean group *Pseudomonas japonica* or *Bacterium japonicum*, while the name *Bacterium* or *Bacillus radicicola* would have to be retained for the peritrichic organisms to be found with clover, alfalfa, sweet clover, vetch, pea, etc.

However, we do not advocate such a procedure. We are firmly of the opinion that much more must be known of the complete life history of a bacterium than is obtainable along the standardized lines of customary bacteriological research, before one can safely proceed to establish a genuine species on a truly scientific basis. Undoubtedly many if not most of the commonly used so-called species names of bacteria are no species names at all, but merely denominations more or less correctly applied to organisms about whose complete life history and, accordingly, about whose true systematic value and position comparatively little is known at present.

It is by no means impossible that future systematic investigations, may demonstrate the peritrichic and the cephalotrichic nodule bacteria to be relatively constant types of growth of one species. There are a few reports in the literature indicating that occasionally cross inoculations have been obtained, which might support this hypothesis. While O. Kirchner never found nodules on soybeans grown in Germany and therefore thought his *Rhizobacterium japonicum* to be the active agent in the Far East, F. Cohn said, in a note appended to Kirchner's report that soybeans grown for the first time in his experimental garden in Breslau did produce nodules, though these were not of the normal type and contained only a few rodlike bacteria. Kellerman reported upon a case where a culture originally isolated from alfalfa was found to be infective on alfalfa and lupine as well as on soja when tested by Leonard after six years' cultivation on artificial substrates. It may be mentioned also in this respect that cross inoculations between navy bean and cowpea seem to be equally possible, under circumstances, however, which need further elucidation.

But just as negative results in cross inoculation experiments cannot be accepted as sufficient basis for establishing different species, so also such rather exceptional positive results cannot be used as valid support of the hypothesis that monotrichic and peritrichic nodule bacteria are only two types of growth of the same species. First of all, it would have to be ascertained whether in such cases the peritrichic organism has really changed into the monotrichic one, or vice versa. The possibility remains, of course, that occasionally the one type of organism may invade a host plant whose nodules are normally caused by the other type of bacteria.

Changes in flagellation from peritrichic to cephalotrichic have been observed, according to Lehmann and Neumann (11, p. 256, 357, 371), with *Bacillus coli* and *B. alcaligenes*. Both species are related to *B. radiobacter* and *B. radicicola*, and under this aspect an analogous change should not be rejected prematurely as *a priori* improbable.

At the end of the introduction three statements have been quoted from the more recent literature which one might be inclined to accept as confirmative evidence in this direction. However, on account of the following reasons we do not feel justified in advocating such an interpretation.

J. K. Wilson says that in his preparations of soybean organism —

> "The flagella were peritrichous, the highest number found being four."

As no photomicrographs had been made, Dr. Wilson was kind enough to furnish, on request of the senior author, one of his slides for examination. The flagella visible therein were all very weakly stained, so that no definite conclusion could be drawn. A culture for which we are also indebted to Dr. Wilson, behaved in our hands like all those tested before: practically all cells were distinctly monotrichous. A comparison of Plate 68, A, with the pictures published on Plates IV and V of Bulletin 202, Illinois Agricultural Experiment Station (6), leaves no doubt about this point.

In Barthel's paper (2, p. 16) two drawings and one photomicrograph are to be found which clearly illustrate the following statement:

"Bei den Lupinenbakterien sind die Geisseln ziemlich lang, wellig geformt und an einem Pole befestigt. Ihre Anzahl variiert von 1 bis 6. Ihre Placierung ist recht eigentümlich. Sie sitzen nämlich öfters nicht gerade an der Spitze des Zellleibes, sondern sozusagen an den "Ecken" und oft etwas von dem Hinterende entfernt. Oft findet man auch eine Geissel an der einen "Hintereeke" und mehrere endere zusammen an der anderen. . .

Bei den Luzernebakterien waren die Geisseln meist weniger und kürser, am haufigsten 1 oder, seltener 3 oder 4, aber auch hier deutlich lophotrich. . ."

Fred and Davenport (7), on the other hand, saw only one or two cilia with the lupine bacteria, while several strains of alfalfa organisms left no doubt as to their peritrichic flagellation.

We believe that these conflicting views are in fact not so irreconcilable as they seem to be. If well-made slides are examined carefully, some cells will always be discovered which clearly show that on account of the primary swelling and the following shrinking of their capsules, the flagella are often more or less dislocated. Some of the cells shown in Plate 68, A-C, exhibit this phase as clearly as it is possible in such reproductions. The flagella of the monotrichous bacteria of the cowpea-soybean group are to be seen in an exactly polar position only when the cells themselves are lying lengthwise within the 'drift', as indicated by the floating flagella. In all other cases dislocations may take place, removing the cilia to the corners or even to the side of the cells, where they should not be viewed, however, as remnants of a peritrichic flagellation.

On the other hand, analogous disturbances may cause

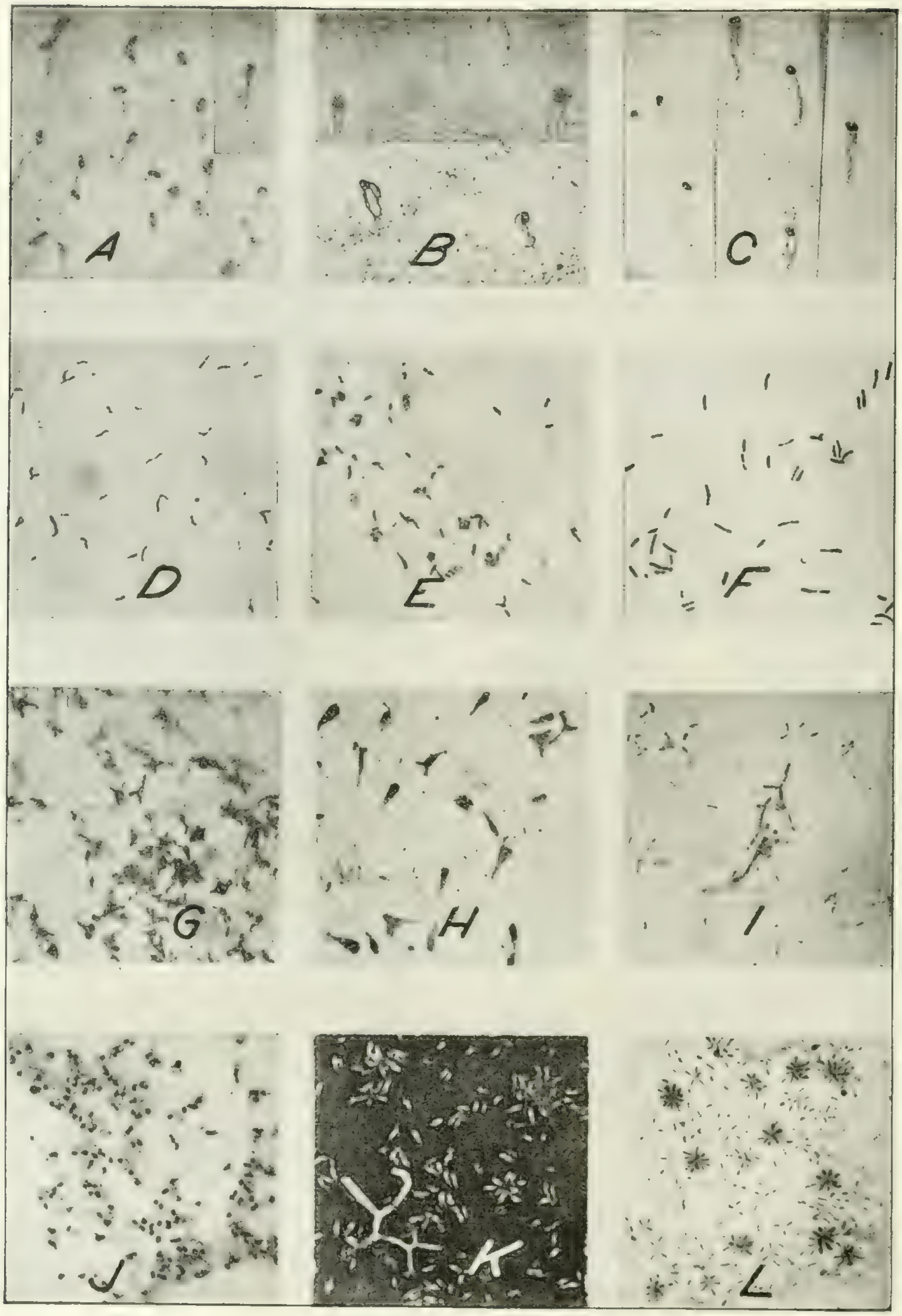


PLATE 68.

A.—Soybean bacteria, J. K. Wilson's strain, 4 days old.
B.—Vetch bacteria, 3 days old.
C.—Bacillus radiobacter, 2 days old.
D.—Soybean bacteria, beef agar, 4 days old.
E.—Red clover bacteria, beef agar, 4 days old.
F.—*Bacillus radiobacter*, beef agar, 4 days old.
G.—Cowpea bacteria, potato, 6 days old.
H.—Red clover bacteria, potato, 14 days old.
I.—*B. radiobacter*, milk, 7 days old.
J.—Cowpea bacteria, mannite-nitrate agar, 8 days old.
K.—Vetch bacteria, mannite-nitrate agar, 8 days old.
L.—*B. radiobacter*, mannite-nitrate solution, 17 days o[illegible].
A—C Loeffler's stain: D—L aqueous fuchsin. X1,000.

the occurrence of apparently cephalotrichic bacteria among the peritrichic cells of *Bacillus radicicola* and *B. radiobacter*. That there exists no truly polar flagellation in these cases, however, is evidenced by the fact that the cilia composing such an apparently polar tuft do not protrude exactly from the same spot, as they do, for example, in the cell with several polar flagella shown in Plate 68, A. They are always more or less separated and are only accidentally drawn together in the course of the shrinking of the capsule. A thorough examination of well-made preparations leaves no doubt that the original position of the flagella is peritrichic.

SUMMARY.

(1) The nodule bacteria of the leguminous plants are to be divided into two groups, differing morphologically as well as physiologically.

(2) The first group shows all features characteristic of *Bacillus radicicola* Beijerinck. It is peritrichic, grows relatively fast on agar plates, and changes the milk in a very characteristic manner. It produces nodules on the roots of the following plants: clover, sweet clover, alfalfa, vetch, pea, navy bean, lupine, black locust, Amorpha, and Strophostyles.

(3) The second group is characterized by monotrichic flagellation, comparatively very slow growth on agar plates, and inability to cause a marked change in milk. It has been isolated from cowpea, soybean, peanut, beggarweed, Acacia, Genista, and Cassia.

(4) According to the customary manner of classifying bacteria, this second group of nodule bacteria would have to be considered to be a new species, and according to the rules of priority, it would have to be named *Pseudomonas japonica* or *Bacterium japonicum* (Kirchner). But we do not advocate such a procedure, because only a complete study of the

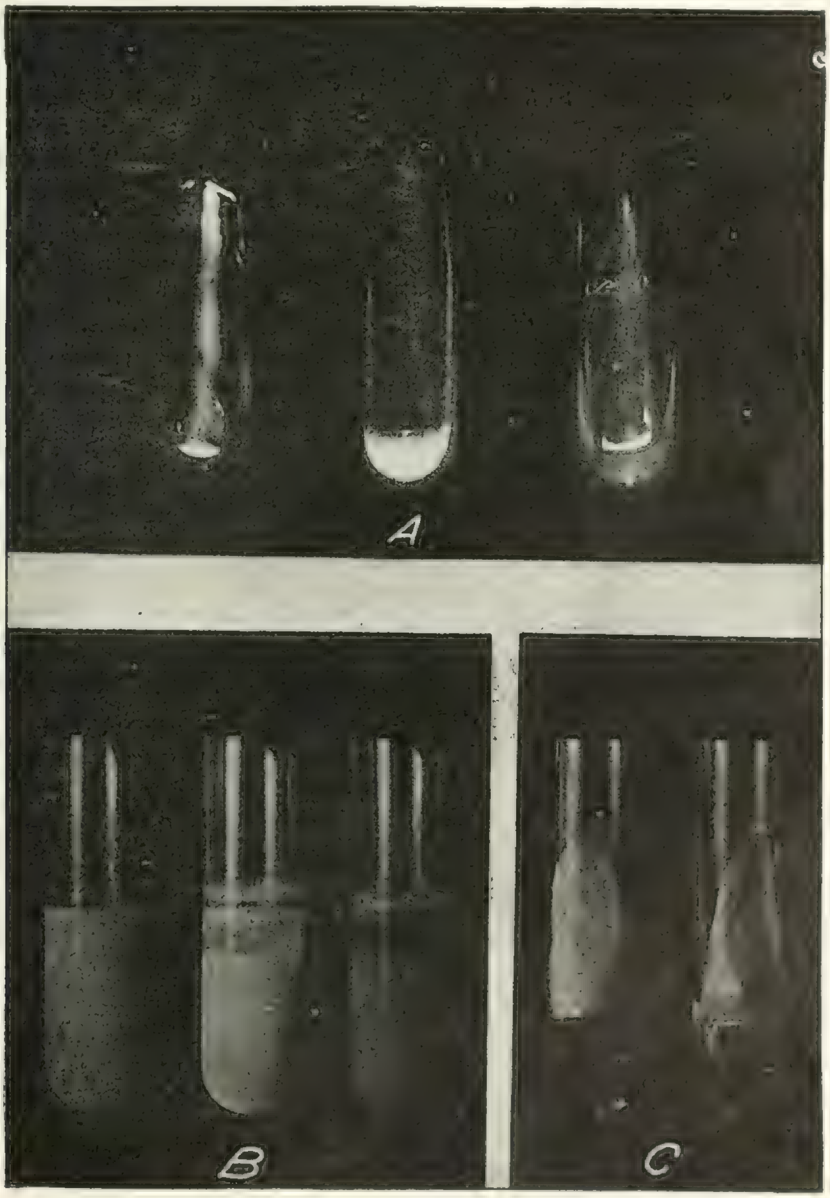


PLATE 69.

A.—Mannite-nitrate agar slants, 8 days old, from left to right: soybean bacteria, vetch bacteria, and Bacillus radiobacter.

B.—Growth in milk, 4 weeks old from left to right: soybean bacteria, vetch bacteria, and B. radiobacter.

C.—Growth on potato, 2 weeks old: vetch bacteria (left) and B. radiobacter (right).

life history of these two groups of organisms would make it possible to say definitely whether they are, indeed, two distinct species or merely different types of growth of the same organism.

(5) *Bacillus radicicola* is closely related to *B. radiobacter*. The generic name Rhizobium is to be rejected. The correct systematic position of both species is in the neighborhood of *B. aerogenes* and *B. coli*.

(6) *Bacillus radiobacter* seems to be regularly present in the root nodules of leguminous plants, stimulating development and activity of the nodule bacteria. On account of its similarity to *B. radicicola*, it has been repeatedly mistaken for the nodule-producing organism in the cowpea-soybean group, whose bacteria it outranks very considerably in the development on the plates made from the nodules. By its brown growth on potato, *B. radiobacter* can be easily differentiated from *B. radicicola*.

LITERATURE CITED

(1) ALLEN, E.R.
1919. SOME CONDITIONS AFFECTING THE GROWTH AND ACTIVITIES OF AZOTOBACTER CHROOCOCCUM. *In* Ann. Mo. Bot. Gard., v. 6, no. 1, p. 1–44, 1 pl. Bibliography, p. 42–43.

(2) BARTHEL, Chr.
1917. DIE GEISSELN DES BACTERIUM RADICICOLA (BEIJ). *In* Ztschr. Garungsbhysiol., Bd. 6, No. 1, p. 13–17.

(3) ———
1919. CULTURES DE BACTERIES SUR TERRE STERILISEE. *In* Meddel. K. Vetensk. Nobelinstitut, bd. 5, no. 2, 13 p., 1 pl.

(4) BEIJERINCK, M. W.
1888. DIE BACTERIEN DER PAPILIONACEEN KNOLLCHEN. *In* Bot. Ztg., Jahrg. 46, No. 46, p. 725–735,pl. 11; No. 47, p. 741–750; No. 48, p. 757–771; No. 49, p. 781–790; No. 50, p. 797–804.

(5) ——— and VAN DELDEN, A.
1902. UEBER DIE ASSIMILATION DES FREIEN STICKSTOFFS DURCH BAKTERIEN. *In* Centbl. Bakt. [etc.], Abt. 2, Bd. 9, No. ½, p. 1–43.

) BURRILL, THOMAS J., and HANSEN, ROY.
1917. IS SYMBIOSIS POSSIBLE BETWEEN LEGUME BACTERIA AND NON-LEGUME PLANTS? Ill. Agr. Exp. Sta. Bul. 202, p 115–181, 17 pl. Bibliographies, p. 161–181.

(7) FRED, E. B., and DAVENPORT, Audrey.
1918. INFLUENCE OF REACTION ON NITROGEN-ASSIMILATING BACTERIA. *In* Jour. Agr. Research, v. 14, no. 8, p. 317–336. L terature c ted, p. 335–336.

(8) Harrison, F. C., and Barlow, B.
1907. THE NODULE ORGANISM OF THE LEGUMINOSAE. *In* Centl. Bakt. [etc.], Abt. 2, Bd. 19, No. 7,9, p 264-272; No. 13/15. P. 426–441, 9 pl.

(9) KELLERMAN, K.F.
1912. THE PRESENT STATUS OF SOIL INOCULATION. *In* Centbl. Bakt. [etc.], Abt. 2, Bd. 34, No. 1|3, p. 42–50, 2 pl. Bibliography of American studies, p. 46–50.

(10) KIRCHNER, O.
1895. DIE WURZELKNOLLCHEN DER SOJABOHNE. *in* Beitr. Biol, Pflanzen. Bd. 7 Heft 2, p. 213–223.

(11) LEHMANN, K. B., and Neumann, R. O.
1912. ATLAS UND GRUNDRISS DER BAKTERIOLOGIE . Aufl. 5, Teil 2, xiv, 777 p. MUNCHEN.

(12) LOHNIS, F.
1905. BEITRAGE ZUR KENNTNIS DER STICKSTOFFBAKTERIEN. 1. UEBER STICKSTOFFIXIERENDE BAKTERIEN. *In* Centbl. Bakt. [etc.], Abt. 2, Bd. 14, No. 18|20, p. 582–597.

(13) ——— and SMITH, N. R.
1916. LIFE CYCLES OF THE BACTERIA. (Preliminary communication.) *In* Jour .Agr. Research, v. 6, no. 18, p. 675–702, 1 fig., pl. A–G. Literature cited, p. 701–702.

(14) Moore, George T.
1905. SOIL INOCULATION FOR LEGUMES . . . U. S. Dept. Agr. Bur. Plant Indus. Bul. 71, 72 p., 10 pl.

(15) PRUCHA, MARTIN J.
1915. PHYSIOLOGICAL STUDIES OF BACILLUS RADICICOLA OF CANADA FIELD PEA. N. Y. Cornell Agr. Exp. Sta. Mem. 5, 83 p. Bibliography, p. 79–83.

(16) ROSSI, GINO de.
1907. UEBER DIE MIKROORGANISMEN, WELCHE DIE WURZELKNOLLCHEN DER LEGUMINOSEN ERZEUGEN. *In* Centbl; Bakt. [etc.], Abt. 2, Bd. 18, No. 10|12, p. 289–314. No. 16|18, p. 481–488, 2 pl. Literatur, p. 483–488.

(17) ———
1909. STUDI SUL MICROORGANISO PRODUTTORE DEITUBERCOLI DELLE LEGUMINOSE. *In* Ann. Bot., v. 7, fasc. 4, p. 618–652, pl. 23.

(18) WILSON, J. K.
1917. PHYSIOLOGICAL STUDIES OF BACILLUS RADICICOLA OF SOYBEAN (SOJA MAX PIPER) AND OF FACTORS INFLUENCING NODULE PRODUCTION. N. Y. Cornell Agr. Exp. Sta. Bul. 386, p. 363–413, fig. 80–94.

(19) ZIPFEL, HUGO.
1911. BEITRAGE ZUR MORPHOLOGIE UND BIOLOGIE DER KNOLLCHENBAKTERIEN DER LEGUMINOSEN. *In* Centbl. Bakt [etc.], Abt. 2, Bd. 32, No. 3|5, p. 97–137. Literatur p. 136–137

ATTENDANCE AT THE CONVENTION.

During the Convention the following members registered their attendance:

P. M. Abel, Winnipeg; J. R. Almey, Winnipeg; A. F. Barss, Vancouver; H. Barton, Macdonald College; W. J. Bell,Kemptville; J. R. Bisby, Winnipeg; J. E. Blakeman, Winnipeg; J. F. Booth, Regina; Geo. Bouchard, Ste. Anne de la Pocatiere; John Bracken, Winnipeg; E. W. Brett, Dugald; A. M. Brown, Oak Point; J. M. Brown, Winnipeg; R. W. Brown, Winnipeg; F. W. Brodrick, Winnipeg.

A. D. Campbell, Winnipeg; A. T. Charron, St. Hyacinth; J. A. Clark, Charlottetown; O. A. Cohagen, Winnipeg; J. H. Ellis, Winnipeg; J. H. Evans, Winnipeg; G. A. Ewart, Regina; F. Foulds, Winnipeg; W. P. Fraser, Saskatoon; F. J. Freer, Winnipeg; Arthur Gibson, Ottawa; K. W. Gordon, Saskatoon; F. H. Grindley, Gardenvale; H. E. Hallwright, Victoria; R. S. Hamer, Ottawa; T. J. Harrison, Winnipeg; W. H. Hicks, Agassiz; E. A. Howes, Edmonton; J. E. Howitt, Guelph;John Hudson, Winnipeg; R. Innes, Ottawa; V. W. Jackson, Winnipeg; D. M. Johnson, St. Boniface; M. A. Jull, Macdonald College; J. K. King, Moncton; L. S. Klinck, Vancouver; F. Laughland, Winnipeg; W. R. Leslie, Fort William; F. Letourneau, La Trappe; A. V. Mitchener, Winnipeg; A. C. McCulloch, Winnipeg; H. MacFayden, Winnipeg; L. H. Newman, Ottawa; R. Newton, Edmonton; J. C. Noble, Winnipeg; J. N. Ponton, Montreal; C. S. Prodan, Winnipeg; L. C. Raymond, Macdonald College; J. B. Reynolds, Guelph; W. B. Roadhouse, Toronto; J. G. Robertson, Regina; L. P. Roy, Quebec; G. E. Sanders, Annapolis Royal; H. Saville, Regina; H. B. Smith, Winnipeg; J. M. Smith, Edmonton; W. Southworth, Winnipeg; A. K. Stratton, Stonewall; W. W. Thomson, Regina; W. P. Thompson, Saskatoon; A. A. Toole, Winnipeg; R. C. Treherne, Vernon; W. E. Watson, Winnipeg; E. A. Weir, Winnipeg; G. W. Wood, Winnipeg; H. E. Wood, Winnipeg.

A number of others who were in attendance failed to register.

Accredited Herds

Abstract of Address by Dr. Frederrick Torrance, Veterinary Director General, Ottawa.

(Delivered before the Eastern Ontario Branch of the C.S.T.A.)

Bovine Tuberculosis is of more significance to humanity than is generally realized. Its existence is of vast importance from the following points of view:—

1st. Lessening of the food supply. In the year ending April 30, 1920, Canada lost 4,836 cattle and 3,518 swine whose carcases were tanked as too badly affected by this disease to be of any value except for grease and fertilizer. In addition there were also lost 34,805 portions of beef carcases and 794,578 portions of pork carcases. These amounts were lost from the abattoirs under federal inspection alone, and a further unknown amount was lost at private slaughter-houses.

2nd. Heavy losses occur on farms in deaths from tuberculosis, in sterility, emaciation, and lack of milk production. The supply of meat food is definitely lessened on account of this disease.

3rd. The loss of human life. Bovine tuberculosis is transferable to human beings, chiefly through the medium of milk from tuberculous cows. As milk is the natural food of young children, it is natural to expect that this infection would appear most frequently among children, and this is the case. Investigators tell us that a large proportion (at least 25 per cent) of tuberculosis found in children under the age of five years, is of the bovine type, in other words, has been received from cow's milk.

Some medical experts claim that much of the tuberculosis of adults is derived from infection received in early years from bovine sources and has lain dormant in the system until some adverse influence, such as exposure, fatigue, or insufficient food has lowered the vitality and permitted the infection to develop. Veterinarians have realized these facts for many years and have endeavoured by persistent effort to obtain the cooperation and support of the public in an effort to lessen the extent of bovine tuberculosis. Indifference and lack of information have prevented these efforts from bearing fruit until comparatively recently, when the problem of attacking bovine tuberculosis has crystallized itself into certain definite channels, upon which the energies of the veterinary profession are now largely directed.

One of these is the accredited herd system, based on an idea first promulgated in the International Bovine Tuberculosis Commission. It is founded on the idea that if our pure bred herds could be cleaned up it would not only furnish an object lesson to all stock owners in the country, but would also prevent the dissemination of disease which has been going on for many years through the medium of pure bred animals purchased for the improvement of stock. Pure bred bulls, when derived from diseased herds, have been the means of disseminating tuberculosis among herds hitherto healthy and have carried the disease into localities where previously it was unknown. In order to clean up these herds it was necessary to secure the co-operation and hearty goodwill of the breeders. This was finally obtained at a joint meeting of representatives of the various breeders and of the United States Live Stock Sanitary Association, and rules were drawn up for the so-called accredited herds. These were adopted in 1917 and the United States Government immediately accepted them and placed the accredited herd system in operation.

The plan is briefly as follows: The owner of a pure bred herd, who applies for Government assistance, in order to place his herd on the accredited list, is immediately visited by the veterinary officials entrusted with this work. His herd is submitted to a careful test. Animals which react are either destroyed or placed in a separate herd to be maintained in isolation and under strict rules. These isolated herds are known generally as Bang herds, from the fact that Professor Bang, of Copenhagen, was the first to advocate this method of dealing with infected herds. When an owner decides to have his diseased cattle slaughtered, rather than place them in a Bang herd, this is always done under the supervision of a veterinary inspector, who decides what portion, if any, of the carcase is to be used as beef. The owner receives compensation up to a certain amount, based upon the valuation of the animals.

In the United States this compensation is paid partly by the Federal Government and partly by the State, while in Canada it is paid entirely by the Federal Government. Compensation never amounts to the full value of the animal, so that in cleaning up a herd there is always a certain loss which falls upon the owner, but is made up to him by the increased value of the healthy herd when it is fully accredited. This has been estimated at 20 to 25 per cent, and is one of the large inducements for a breeder to have his herd accredited.

The progress of the work has been extraordinarily rapid, so great in fact that the resources of the Governments, both of the United States and Canada, have been taxed to the limit to find the men and money necessary for carrying it on. In the United States, where the system has already been in operation for over three years, they have more than 4,000 fully accredited herds, that is herds which have passed two annual or three semi-annual tests without a reactor being found, and they also have upwards of 20,000 other herds which have been once tested without a reactor.

In Canada, where the work began a little over one year ago, we have already 379 owners of herds who have applied for the test, upwards of 12,000 cattle have been tested, and there has been paid out in compensation over $175,000. An encouraging feature of the work is that while the initial cost of removing the diseased animals from a herd and paying compensation for them is often very heavy, subsequent tests usually reveal comparatively few diseased animals. The initial cost is, therefore, by far the heaviest and if sufficient money can be obtained for carrying on the work, a few years should enable us to pass the peak of the expense, and subsequent years will reveal a very substantial saving.

A Bacteriological Analysis and Cultural Test of "Nitro-Bacter Soil Vaccine"

DAN. H. JONES, Professor of Bacteriology, O.A.C.,
Guelph.

"Nitro-Bacter Soil Vaccine" is a liquid preparation recently put upon the market and widely advertised as giving wonderfully increased crop returns when applied to the soil on which the crops are grown. It is claimed by its manufacturers to be a culture of bacteria, which, on addition to the soil, "attach themselves to the plant roots and draw nitrates and phosphates from the air and soil and act in place of fertilizers."

As we have received many letters of enquiry regarding this preparation we obtained from the Toronto branch of the firm that manufactures it a free gallon sample for analysis and test. The sample was from a lot manufactured May 10th and the culture tests here reported were commenced June 2nd. A portion of this sample has been applied to various crops and a portion used for bacterial analysis. The crop test will not be complete until the end of the growing season but the bacterial analysis is sufficiently far advanced to warrant a report being made.

The analysis included bacterial counts made on various culture media and cultural tests for production of ammonia, nitrites and nitrates. Standard methods were used throughout.

Coincident with the "soil vaccine" test we ran for purposes of comparison similar tests with a soil suspension made by adding one part of garden soil to two parts of sterile water, shaking and allowing the soil to settle and then using the supernatant liquid for cultural purposes.

The results of these comparative tests are as follows:

Number of Decomposition Bacterial Colonies Growing on Beef-Agar-Plates.

"Soil Vaccine"	*Garden Soil.*
50,000 per c.c.	16,000,000 per gram.

Azotobacter Colonies (nitrogen-fixing bacteria) Growing on Ashby's-Agar-Plates.

"Soil Vaccine".	*Garden Soil.*
1 in 3 c.c.	900 per gram.

Other Types of Bacterial Colonies on Ashby's-Agar-Plates.

"Soil Vaccine"	*Garden Soil.*
Numerous streptothrix,	Few streptothrix.
A few acid producers.	Some legume bacteria.
Few others undetermined.	Many others undetermined.

From the above it will be seen that when comparing the bacterial content of 1 c.c. of the vaccine with that of 1 gram of ordinary garden soil, the decomposition bacteria were thirty-two times as many in the garden soil as were found in the "soil vaccine", and that the azotobacter, or nitrogen-fixers, were twenty-seven-hundred times more numerous in the garden soil than in the "soil vaccine".

Ammonification Test.

In this test a comparison was made in triplicate between the "soil vaccine" and the water suspension of garden soil for their power to ammonify gelatin solution. To each of three flasks containing 100 c.c. of gelatin solution 5 c.c. of the "soil vaccine" was added, and to each of a similar set of flasks 5 c.c. of the garden soil (equivalent to 2.5 grams soil) was added.

After four days a chemical test for ammonia was applied and this showed in the "soil vaccine" culture a slight amount of ammonia, while the garden soil culture showed heavy ammonia production. Two days later a similar test was applied which showed moderate amount of ammonia for the vaccine culture and very heavy ammonia for the garden soil culture. These results tally with the bacterial counts made on the beef agar plate cultures, the slow production of ammonia in the "vaccine" flask cultures agreeing with the small number of decomposition bacteria found in the "vaccine" plate cultures, while the rapid ammonia production by the garden soil flask cultures corresponds to the large number of decomposition bacteria found on the garden soil plate cultures.

Nitrification Tests.

A. *Formation of nitrites* (This is a necessary stage in the building up of nitrates).

Comparison tests were made in triplicate between the "soil vaccine" and the water suspension of garden soil to form nitrites in a solution made for nitrite production.

To each of three flasks containing 50 c.c. of the solution 0.5 c.c. of "vaccine" was added and to each of a similar set of three flasks was added 0.5 c.c. of garden soil suspension (equivalent to a quarter of a gram of garden soil).

After six days a chemical test for nitrites was applied with the following results:

"Soil vaccine" cultures showed no nitrite production; garden soil cultures showed moderate amount of nitrites present. After twelve days the same test was again applied when it was found that a trace of nitrites was present in the "soil vaccine" cultures while a heavy nitrite content was found in the garden soil cultures.

B.—*Production of Nitrates.*

For this test 0.2 c.c. of the "soil vaccine" was added to each of three flasks containing 50 c.c. of a solution prepared for the formation of nitrates and the same quantity of garden soil suspension, equivalent to 0.1 gram of soil, was added to a similar set of flasks.

In this test for nitrate production it is desirable to incubate the cultures for from four to six weeks before making the chemical test for determining presence of nitrates. At time of writing the cultures for this test have been incubated only two weeks. However, we have just made a preliminary test and we find no nitrates produced in the "soil vaccine" cultures whilst there is a slight amount of nitrate found in the garden soil cultures.

Conclusions.

A consideration of the above findings shows that for increasing the denitrifying, ammonifying, nitrifying and nitrogen-fixing bacterial content of the soil the "soil vaccine", if the sample forwarded to us is a representative sample, is of little, if any, value. Further,

when it is diluted according to directions for application to the soil the number of these bacteria thus added to the soil by the "vaccine" would be like a drop in a barrel.

If, as is claimed, the virtue of the "soil vaccine" depends on its bacterial content, and if the sample tested by us is an average sample, then the above bacteriological findings indicate that the "vaccine" is not all that it is claimed to be.

While our crop tests in general are not very far advanced an examination of two rows of corn, one of which was treated with the "soil vaccine", and the other with a light dressing of stable manure, shows decidedly in favor of the stable manure.
(Guelph June 20, 1921).

The Task of the Technical Agriculturist

An Outsider's View.

Agriculture is sometimes treated as a business, and the land owner considered in his capacity of the great capitalist, whose total holdings exceed those of all other capitalists manyfold. At other times we think of the farmer as a laborer, and of his occupation as labor, with its concomitant considerations of wage and hours. Both views are obviously justified, and both fail to treat agriculture with the proper breadth.

For agriculture is neither a business nor a calling—it is our attempt to solve the problem of maintaining human life on this planet, and of improving its condition. Were it not for the fact that one man's labor, on ordinary soil, will more than suffice to maintain one average family, organized society could not exist, and the world would be peopled by a race of hopeless beings, struggling for a bare existence, and sacrificing the old and weak, as is now done in lands where a redundant population or an exhausted soil, make the burden of supporting a family more than the workers of a family can bear.

Consequently, any attempt to intelligently study agriculture cannot be successfully confined to the physical problems of the improvement of livestock and food plants, nor can it limit its investigation of economics to the question of buying and selling to the best advantage. To these details of study must be added an intelligent analysis of the economic history of the surface, and to turn from hunting and the pasturage of cattle to the tilling of the soil.

For our purpose it will be unnecessary to go back further than the middle of the eighteenth century, when the invention of machinery and the accompanying perfection of our financial system commenced to influence the course of human life to any appreciable extent.

At that time society, in the two states which have furnished Canada with the majority of her population —Great Britain and France—had, for the first time since the fall of the Roman Empire, reached a condition of general civilization. Arts and letters, the science of government and the conception of ethics, the private comfort of the people and the public order of the state had all reached as high a standard as ever before in human history. Yet, and for one reason alone, the change that has occurred since then far exceeds in magnitude the total difference between the England of the Georges and that of Alfred—for machinery in the modern sense, did not exist.

In 1750 each state of Europe, and almost each village, was an economic unit, producing the total requirements of its people in food, fuel and clothing. Luxuries were imported, and some articles of foreign production, as for example, sugar, tobacco and cotton, were already becoming necessities, but, in general, a threat to close the English seas to ships would have involved nothing more than discomfort to the average Englishman.

At this time, North America had been partly colonized, but these colonies were patterned on their mother countries, and were communities who did not contemplate any other destiny than to produce their own requirements, and to consume their own production, with a modest trade in purely American commodities bartered for the special articles which they had not yet attempted to produce.

The long strain of the Napoleonic wars left our mother countries in a condition of depleted wealth, without causing a corresponding decrease in population and it was in the attempt to correct this state that resource was had to the expedient of emigration to the virgin lands of the West, and that men turned their thought to the studies that produced the steam engine.

The untouched soil to which this great rush of people was directed proved, as might have been foreseen, ready, with a less amount of labor than had been the case in the other lands, to produce crops far beyond the needs of the settlers, and the lack of a landowner, demanding half the colonist's labor to pay his rent, left a great proportion of this available for sale. These food commodities were naturally cheaper than those of the high priced lands of Europe, and the inevitable result was to drive European communities to seek for some method of obtaining them. The application of power to manufacture was one result, as it enabled the English laborer to create commodities with which to buy American wheat. Equally natural was the development of power transportation that made this barter physically possible.

There remained the difficulty of obtaining capital with which to create these means of production and transportation. Up to this period in the world's history, money had meant silver and gold, and the supply of these metals was totally inadequate to provide the means of financing the creation of a New World. Thus, slowly but surely, was developed the modern system of credit, by which natural resources, community action, and even private agreement could be used as the basis for an issue of paper money.

With this last difficulty overcome, the process of peopling the New World, and of transforming the more advanced portions of Europe into huge workshops, proceeded at a constantly accelerated rate, and, indeed, was extended to the point where labor commenced to abandon the farms of Eastern North America for the factory or for the virgin soil of the prairies.

How far this process could have continued will never

be known, as the Great War intervened, and by stretching the system of paper credit to the breaking point, put a stop to any further building of railways and factories, financed by drafts on potential future profits, if, indeed, it did not render the present railways and factories incapable of continuance on the existing scale.

So far in retrospect. For the present, we have, the world over, a condition of surplus labor, due, in Canada at any rate, to the sudden cessation of employment of the large portion of our population that has for a generation, directly or indirectly, been engaged in the building of railways and the like, with paper capital, plus those of the Western wheat miners whose market has vanished owing to the impoverishment of Europe.

We may, in the future, resume the march, and see wheatfields stretching to the Arctic Circle. For the present, if this country is to continue as an organized community, immediate steps must be taken to absorb into the genuine industry of mixed farming the unemployed of the city, as soon as these men realize their acute need of employment, and have exhausted political and other channels of effort in the direction of avoiding the necessity of seeking it from the present owners of land.

Two great objections present themselves. The question as to the ability of owners of land to obtain a profit from the labor of these generally inexperienced workers, especially in a time when the markets for commodities are already shrinking, is one. This subject needs a more extended treatment than can be given at this moment, but it may be pointed out that the law that labor applied to the land will suffice to do more than support the existence of the laborer, reduces this problem to the much simpler one of finding a means whereby the farmer, in his absence of an urban market, may avail himself of the surplus labor of his employee, and that this problem has been solved successfully throughout the history of the world. The further question of how will the owner of land obtain the capital necessary to enable him to finance the additional labor, and their equipment until such time as the first returns of their labor become available, is the subject of this article.

This, especially in the present condition of Canadian agriculture, is indeed a problem. It cannot very well be done by the same means that provides the capital for our commercial operations, firstly, because, as has already been stated, the system of credit that provides that capital is greatly strained already, and secondly, because that system requires much quicker returns than can be offered by the farmer who wishes to obtain money to build a cottage for a laborer, whose labor will not return any tangible profit for some years, or who desires to spread phosphates for a result two years away. It cannot be accomplished by governmental action, as we have already plenty of experience in this country as to the impossibility of a government undertaking to successfully substitute public for private enterprise.

The present credit system would provide enough long term capital to accomplish a small portion of the task, were it not for the fact that the tradition of Canadian agriculture, owing to high labor values, and low, or non-existent returns from investment in land, is to regard farming as an occupation for individual operators on their own land, and for them only. This feature, largely fostered by the earnest attempt of every government to educate every farmer into a successful wage-earner will also operate very severely to prevent the present owners of land from realizing their opportunity and their duty in the matter of becoming employers of labor on a scale sufficiently large to absorb the present surplus, and should be combatted in every way by those who would solve the problem.

Capital for such long term operations can only be provided by the landowners themselves, and it is precisely here that we can find the only surplus source of credit for the creation of money that can be tapped to-day—the value of the land.

After deducting the mortgages against the lands of Eastern Canada, there remains a great value, the property of the land owners, enough to finance the transfer of our total surplus city population to the land, and of a practically unlimited number of desirable immigrants as well. The problem of organizing this value into a form ready for employment, in the form of money, is not one to be solved by any general method of land banks or farm credits. It will automatically solve itself, as soon as the owners of land realize the possibility of using their land, and the labor that is fast becoming available, to their own profit, regardless of the course of city demand for farm commodities.

The activities of our governments in the direction of improving agriculture have given rise to many very fallacious ideas, and to some actual abuses. One unadulterated good has resulted—the creation of a body of trained technical students of agriculture, who would otherwise, doubtless, have drifted into other branches of applied science. Is it too much to hope that these men will devote their energies to the great and imminent question of solving the difficulties that seem to prevent the farmer from seizing his opportunity, and facing his duty, of absorbing the fast increasing surplus of labor in the country?

The landowner will soon find a means of creating the money with which to finance the movement. What he needs to-day is a little less advice as to the kind of livestock and crops to use, and a little more instruction as to the possibility of successfully using his land to support directly the men who have, for some time past, been supported indirectly by it, in the cities of the country.

Political history teaches us that that country is ever happiest in which the greatest proportion of the people draw their life most directly from the soil. This Dominion is wealthy enough in natural resources to support many times its present population, yet riotous mobs recently invaded eating houses in our greatest city, pleading starvation for lack of work.

The problem of the return to the land has been vainly approached by many states, ever since Rome fell, because her agriculture had declined; it cannot, because of the impossibility of realizing the vision of the social dreamers, be solved by governmental action. The only man who can attract labor to the land is the landowner, and by the offer of a better living than can be obtained elsewhere for the same effort. This has not been possible in Canada for a generation. It appears to be almost possible to-day. It will be a national tragedy if the landowner cannot cease for a while to think of the details of agriculture, and devote himself to the solution of its main problem—the maintenance of human life on the earth.

P. C. ARMSTRONG, Sweetsburg, P. Q.

Amendments to Constitution and By-Laws

Some of the amendments made to the Constitution and By-laws at the recent Convention were quite important, while others were of comparatively minor importance. At the present time it is not possible to print a completely revised constitution, but the amendments made are given here for the information of the members, with whatever explanation appears to be necessary.

Associate Members. Article 3 of the Constitution was revised to make provision for associate members and now reads in part as follows:

"Membership: There shall be three classes of members, regular, associate and honorary.

1. A regular member must be (a) a graduate in agriculture from a university or college of recognized standing. (b) A graduate of a university or college who is engaged primarily in agricultural research, administration, education, extension work, publicity, experimental problems, or other forms of allied work of a scientific or managerial nature or (c) a non-graduate who is engaged primarily in agricultural research, administration, education, extension work, publicity or experimental problems and be accepted as provided for in the by-laws.

2. Associate membership shall be open to those engaged primarily in agricultural research, administration, education, extension work, publicity or experimental problems, who are not at the time eligible for regular membership, and to the undergraduates of agricultural colleges. Members of this class must be accepted by the Dominion Executive. They shall have no voting powers."

A slight change was made in Article 7 of the Constitution, leaving it optional for each Convention to fix the place of meeting for the next convention, or to delegate that duty to the Dominion Executive.

Quite a number of changes were made in the by-laws on the recommendation of the Dominion Executive Committee. These were:

(a) That application for membership may be made either to the local secretary or the General secretary instead of only to the local secretary (Art. I, C1, 2.)

(b) That fees may be payable to either local secretary or general secretary, instead of only to the general secretary, (Art. 5.)

(c) That the Annual Convention may be held at any time after May 31st of each year at the discretion of the Dominion Executive Committee, instead of having to be held within 21 days after May 31st. (Art. 4, C1, I.)

(d) That the annual membership fee shall be retained at $10 for all classes of members, but that $2 of this amount shall go to the local branches, (Art. 5.)

It was made quite plain from the financial statement for the past year, and the expenses to be incurred during the coming year, that no material reduction in fee was possible. It was considered that a 20 per cent reduction should be made in the fee which was paid to the central office, but that the local branches should have the benefit of the amount thus saved. This arrangement will be tried during the present year, and it is expected that the local branches will be considerably more active.

(e) That the Publications Committee (Art. 8, Cl.I. P. "c" and Art. 8, Cl. 4. P. "c" should be discontinued, and an editorial board substituted. The personnel, duties and method of election of this Board are thus defined:

"An Editorial Board shall be appointed by the Dominion Executive which shall consist of two members from each division of agriculture, one member to retire each year from each division, the retiring member to be eligible for re-appointment.

"The duties of the Editorial Board shall be to assist the editor of the official organ of the society in reviewing articles submitted for publication and in passing upon the merits of the same, and to also assist in collecting articles suitable for publication." (New Article 9.)

(f) That the Dominion Executive may meet when and where they may decide, instead of at least twice yearly. (Art. 4, C1, 6.)

(g) That the annual election ballot should call for votes for two vice presidents instead of a first and a second vice-president. (Art. 7, C1, I). Further provision was made that "when the ballots for the annual election of officers are being counted, if the first vice-president elected be English-speaking, only the French speaking candidates shall be considered for the position of second vice-president and vice-versa." (Art. 7, New C1, 3.)

This clause was introduced to insure that at least one of the four named officers of the society should be a French speaking member.

Members who have copies of the constitution and by-laws (page 224 of last issue) should make the changes indicated above. An effort will be made to have revised copies available at an early date.

CORRECTING AN ERROR.

On page 213 of the last issue, a line was omitted from the first paragraph of the article by Miss Margaret Newton, entitled "A Preliminary Note on the Occurrence of Biologic Forms of Wheat Stem Rust in Western Canada".

The opening paragraph should read as follows: "Until 1916 only one biologic form of stem rust was known to occur on wheat. During that year a form of stem rust was collected by Stakman and Piemeisel in the Palouse district of Washington and Idaho to which certain varieties of wheat were almost immune, although these same varieties were readily susceptible to a stem rust collected at St. Paul, Minnesota. This susceptibility and immunity of the same variety of wheat in different localities could only be explained by assuming that at least two biologic forms of the rust fungus must be present, and that each form could affect only certain wheats."

AGRICULTURE AND CAPITAL.

The views expressed in the article published on page 267 of this issue, may not be accepted by all our readers as being sound in principle. They do, however, represent an original thought and for that reason merit expression in print. Many of our readers must have opinions of their own in regard to the important question raised in Mr. Armstrong's article, and its publication may therefore be expected to result in interesting discussion or comment.

Concerning the C. S. T. A. and Its Branches

BY THE GENERAL-SECRETARY.

RESOLUTIONS.

In addition to the resolutions on the Bureau of Records and on Agricultural Research, which are published elsewhere in this issue, the following were also passed at the Winnipeg Convention:

1. **Whereas** it is desirable that definite and uniform policies of agricultural education should be adopted by the various departments and institutions directing or carrying on work of this nature throughout the Dominion;

Therefore Be It Resolved that a Committee of this Society be appointed to enquire into the matter and report at the next Convention.

2. Inasmuch as the finance of this Society would not have permitted the publication of such a creditable and praiseworthy periodical as was made possible by the generosity of the Industrial and Educational Publishing Company of Gardenvale, this Society conveys its hearty and unanimous appreciation of such generosity and pledges loyal support and greated effort to make for "Scientific Agriculture" a wider field and circulation.

3. **Resolved** that the Canadian Society of Technical Agriculturists express their deep appreciation of the most generous welcome extended to them by the City of Winnipeg that so graciously entertained them in their magnificent park at luncheon; by the Provincial Department of Agriculture that attended to their every comfort through their genial Deputy Minister, J. H. Evans, who has so well represented the western spirit of hospitality; by the Manitoba Agricultural College that gave their best, placing before the agriculturists a banquet representative of many of the good things of this Province and freedom to every Department and Branch of the Institution, under the guidance of the heads of those Departments; by the Board of Trade of Winnipeg who gave a most excellent farewell luncheon on June 17th; by the Press of Winnipeg who extended many courtesies and gave nation-wide prominence to the deliberations of the Convention; and by the Canadian Pacific Railway which granted many privileges and extended many courtesies.

Applications for Membership.

In addition to the 557 names included in the preliminary Convention programme, the following were admitted to membership prior to June 20th:

Abel, P. M. (Manitoba, 1913), Grain Growers' Guide, Winnipeg; Almey, J. R. (Toronto, 1921), Dept. of Agriculture, Winnipeg; Blakeman, J. E. (Manitoba, 1913), Dominion Seed Branch, Winnipeg; Cohagen, O. A. (Iowa, 1907), Nor-west Farmer, Winnipeg; Evans, J. H. (Manitoba, 1912), Deputy Minister of Agriculture Winnipeg; Foulds, F. (Toronto, 1916), Dominion Seed Branch, Winnipeg; Freer, F. J. (Saskatchewan, 1915), Soldiers' Settlement Board, Winnipeg; Hudson, John (Manitoba, 1915), Soldiers' Setlement Board, Winnipeg; Laughland, F. (Manitoba, 1921), Soldiers' Settlement Board, Winnipeg; MacKay, N. C. (Toronto, 1911), Dept. of Agriculture, Winnipeg; Prodan, C. S. (Manitoba, 1921), Dept. of Agriculture, Winnipeg; Roadhouse, W. B., Deputy Minister of Agriculture, Toronto; Smith, H. B. (Toronto, 1906), Nor'-West Farmer, Winnipeg; Toole A. A. (Toronto, 1912), Nor'West Farmer, Winnipeg; Watson, W. E. (Manitoba, 1918), 504 Scott Block, Winnipeg; Weir, E. A. (Toronto, 1912), Provincial Savings Office, Winnipeg.

The addition of these names increases the total membership to 573.

J. C. McCULLOCH
Secretary, Manitoba Branch, C.S.T.A.

FELLOWS AND HONORARY MEMBERS.

The Dominion Executive Committee of the C.S.T.A. met on the evening of June 14th, in Winnipeg, to consider a number of questions arising out of the Convention programme; among these not the least important was the conferring of Fellowships and Honorary Memberships. The title "Fellow" is given for professional distinction only, and only to members of the Society. Honorary memberships are given to persons not eligible for membership who have rendered the profession valuable or special service.

The following names were recommended by the Dominion Executive Committee, and accepted by the Convention on June 17th.

For Fellowship: Dr. C. E. Saunders, Dominion Cerealist, Ottawa.

For Honorary Membership: His Excellency the Duke of Devonshire, Mr. J. W. Berry, President of the Fraser Valley Milk Producers Association; Mr. Angus McKay, of Indian Head, Sask.; Dr. James Mills, former president of the Ontario Agricultural College, and Hon. N. Garneau, of Quebec.

La Revue Agronomique Canadienne

Section Française de l'Organe Officiel

DE LA

Société des Agronomes Canadiens

Rédacteur: F. Létourneau.

Echoes de Winnipeg

L'idée a germé. La Société des Agronomes Canadiens est maintenant solidement implantée dans chacune des provinces du Canada. Consciente de sa force, elle poursuivra avec fermeté le but qu'elle s'est tracé, et produira chaque année une abondante récolte de fruits dont bénéficiera l'agriculture et le pays tout entier. En d'autres termes, pour employer un mot qui a déjà fait le tour de la presse, elle *servira*. Elle reculera, dans le domaine agricole, les limites de l'inconnu, et fera passer la science, le facteur le plus important de la production, dans la pratique. Elle perfectionnera de plus en plus l'agriculture canadienne, notre principale source de richesses.

La première convention générale de la Société, tenue à Winnipeg les 15, 16 et 17 du mois courant, a été un succès complet, éclatant. Le rapport que nous allons en faire n'aura, malheureusement, ni l'une ni l'autre de ces qualités. Nous le complèterons plus tard. Quant à l'éclat, il n'en possèdera jamais.

Durant trois jours, une centaine de délégués, comptant parmi les maîtres de la pensée agricole au pays, ont étudié sérieusement, avec compétence, les problèmes agricoles canadiens et formulé des moyens d'action dont l'application ne laissera pas de faire entrer notre agriculture dans une ère de progrès inconnue jusqu'ici. Ce qu'il faut aujourd'hui, ce sont des directives, des mots d'ordres. Ceux qui tiennent dans leurs mains les destinées de la nation, ceux qui administrent la plus importante de nos forces, l'agriculture, savent qu'ils en ont besoin plus que jamais. Or, dans le domaine qui nous occupe, ces idées fécondes, ces mots d'ordre, pourraient-ils venir d'une meilleure source que da la Société des Agronomes Canadiens? N'a-t-elle pas pour elle la compétence? Souhaitons donc que l'harmonie qui règne entre la Société et les corps publics continue à exister. Travaillons en coopération. Donnons à la science la place qu'elle mérite.

Il y avait à Winnipeg une centaine de délégués. Toutes les provinces étaient représentées. L'un des grands mérites de la Société aura été de permettre aux techniciens agricoles des différentes provinces de se réunir, de se connaître, de développer en eux l'esprit national, de les rendre moins provincialistes et plus canadiens.

La Société ne pouvait choisir pour tenir sa première convention un meilleur endroit que Winnipeg. La ville de Winnipeg surgit au centre même du pays. Elle relie l'Est à l'Ouest. Cela s'associe bien avec le caractère national de la Société. On aurait pu aussi faire une comparaison entre la Société et la métropole de l'Ouest. La ville de Winnipeg s'est développée rapidement. Il y a trente ans, ce n'était qu'un petit village. Aujourd'hui elle a une population de 260,000 âmes. Elle doit sa prospérité à l'agriculture. Ce sont les plaines de l'Ouest qui ont fait Winnipeg. La croissance de notre Société a aussi été rapide. Elle a été fondée dans le but de venir en aide à l'agriculture, de la développer davantage. La ville de Winnipeg, qui compte sur ce développement pour s'agrandir encore, ne peut donc rester indifférente devant la science agricole. Les citoyens de Winnipeg savent cela. Aussi ont-ils reçu les délégués à bras ouverts.

Le Ministère de l'agriculture et le manifique collège de la province du Manitoba ont aussi souhaité à la Société la plus sincère et cordiale bienvenue.

Cette réception de la part du Maire, de la Chambre de commerce, du Gouvernement, du Ministère de l'agriculture restera dans les annales de la Société.

Les séances ont été présidées par M. Klinck. L'adresse qu'il a prononcée sera traduite et publiée dans les journaux et la Revue Agronomique. Le président Klinck détermine, dans ce discours, les différents objectifs de la Société et refute les arguments de ceux qui se demandent encore ce qu'un technicien agricole peut attendre de cette Société. Cette adresse est à lire. Le Secrétaire général a présenté son premier rapport annuel. Il a fait l'historique de la Société, a parlé de ses débuts difficiles, des initiatives qu'elle a prises durant le cours de l'année qui vient de s'écouler et de son état actuel. Elle compte présentement près de 600 membres et n'est pas encore trop endettée. Un contingent nouveau lui viendra peut-être avant longtemps du côté de Toronto.

Le Dr Swaine, du Service de l'entomologie, membre du comité de recherches, a donnà lecture d'un travail très important sur les recherches à poursuivre dans les différentes branches de l'agriculture. Il en mentionne pas moins de 500. Ainsi l'évolution de la science agronomique se continuera dans les laboratoires et sur les fermes expérimentales.

Les clauses "b" et "c" de l'article des constitutions regardant les membres ont été amendées. A l'avenir, il faudra, pour devenir membres réguliers, consacrer tout son temps aux travaux agricoles.

L'article concernant les élections a aussi été amendé. Les membres canadiens-français seront toujours certains à l'avenir d'avoir l'un des leurs dans l'exécutif national. Le bureau de placement dont il a été question déjà sera constitué. Le secrétaire général s'occupera de la chose. Il a été longuement question de la coordination qui devrait exister entre le Ministère fédéral et les Ministères provinciaux de l'agriculture. Un comité, nommé par la Société, fera une enquête sur le sujet.

La prochaine convention aura lieu à Montréal.

Nous regrettons de ne pouvoir noter aujourd'hui que les principaux points qui ont été débattus à la convention. Nous y reviendrons.

Disons en terminant que la Société est bien vivante et qu'à l'avenir il faudra compter avec elle.

Pronostic sur le Developpement de la Production et du Commerce des Semences de Céréales dans le Québec

Par LS. PHILIPPE ROY,

Ministère de l'Agriculture, Québec.

Le cultivateur québecois n'avait, jusqu'à ces dernières année, apporté que très peu d'intérêt à la production des semences de céréales comme source de revenus

L.-P. ROY.

de son exploitation. Il serait peut-être difficile d'énumérer toutes les causes qui contribuèrent jadis à retarder, dans notre Province, le développement d'une industrie aussi intimement liée à la production agricole.

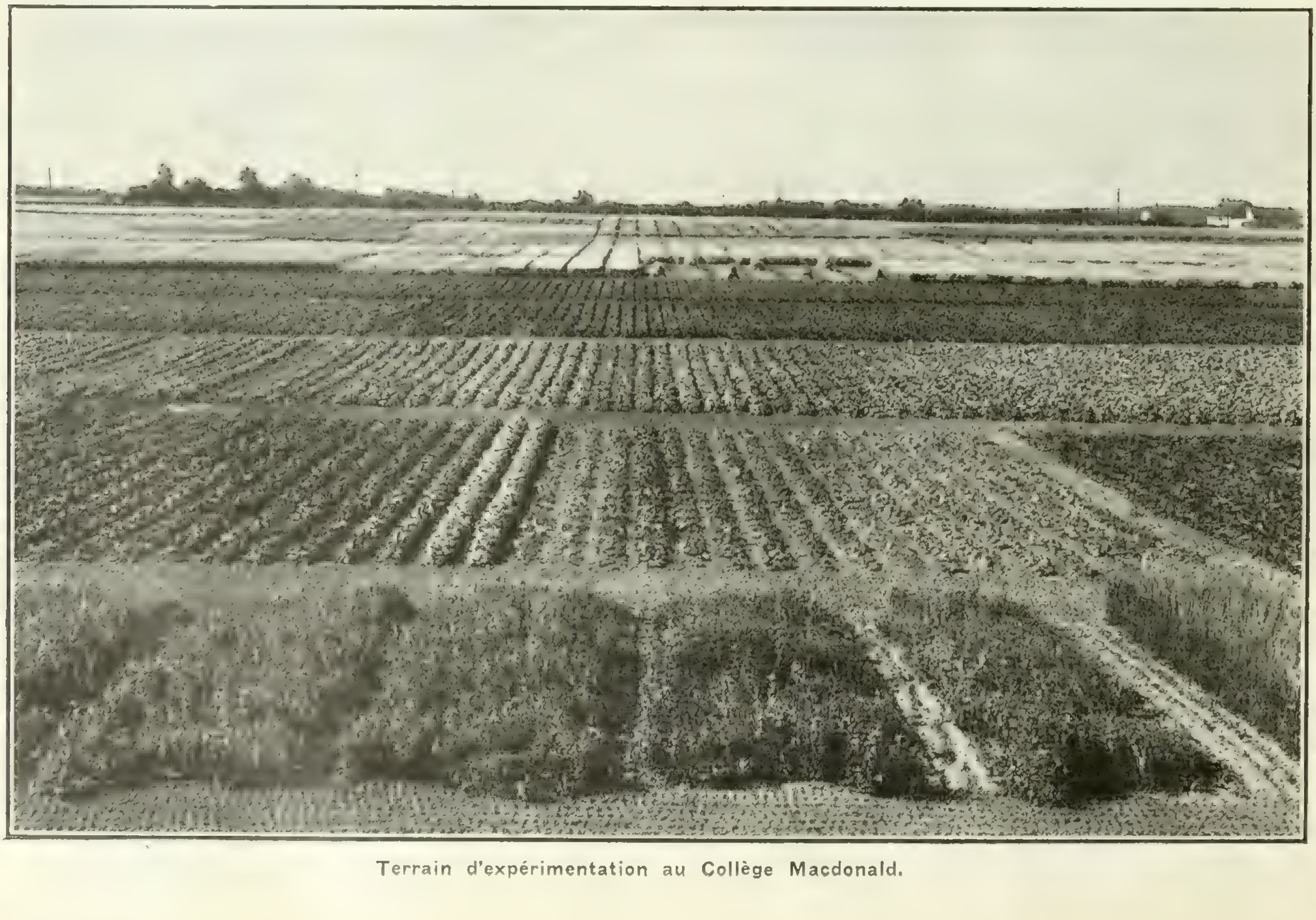
Quelques-unes de ces causes semblent cependant bien se dégager depuis qu'elles ont été éloignées et que derrière, les obstacles aujourd'hui disparus, le mouvement longtemps retardé a repris sa marche ascendante.

Ainsi l'absence, à peu près complète, de stations de sélection et d'amélioration des grains pouvant poursuivre, sous la surveillance d'experts, des travaux de recherches appropriés aux besoins de notre Province; le manque d'organisations indépendantes ayant pour mission de vulgariser, chez nos fermiers, l'emploi et la production des semences améliorées; enfin l'adoption, à peu près générale, par les cultivateurs de cette Province, d'un système de culture mixte, favorisant peu la production des semences comme ligne spéciale, sont probablement là autant de causes qui retardèrent autrefois l'essort d'un mouvement tendant à faire produire sur une base systématique, des semences améliorées par nos cultivateurs.

Heureusement, il n'a fallu qu'un petit nombre d'années pour reprendre le temps perdu et mettre la province de Québec en évidence par sa bonne organisation en ce qui concerne les semences de céréales.

Les progrès récemment réalisés dans cette industrie constituent, en notre sens, l'une des plus belles manifestations de la transformation agricole qui s'est opérée dans cette Province durant la dernière décade.

Parmi les innovations qui ont le plus contribué à ce progrès depuis à peu près 12 ans, nous pouvons citer l'organisation des concours de récoltes sur pied qui sont chaque année octroyés aux sociétés d'agriculture par les Gouvernements Provincial et Fédéral; les expositions de grains de semences—expositions de comtés et exposition provinciale—dont la valeur éducative n'est plus à être démontrée; le développement des champs d'expérimentation de nos collèges d'agriculture qui ont poursuivi, avec beaucoup de succès, des expériences de grande valeur pour la culture de notre Province; la



Terrain d'expérimentation au Collège Macdonald.

fondation d'une société coopérative de producteurs de grains de semences; l'établissement d'une association canadienne qui a établi un enregistrement de nos meilleures lignées de grains et favorisé le commerce de semences certifiées; l'élaboration et la mise en opération d'une loi fédérale pour prémunir les cultivateurs contre les fraudes du commerce en ce qui regarde la pureté et la qualité germinative des semences; enfin, comme dernière et très importante innovation se rapportant aux semences, il faut citer les concours de semences qui ont, depuis deux ans, été organisés dans plusieurs districts de cette Province par les Gouvernements Provincial et Fédéral, dans le but de faire produire, sur une grande échelle, les semences pures de généalogie connue.

Les nombreuses organisations qui viennent d'être citées sont, ainsi qu'il est dit plus haut, d'une origine plutôt récente. Elles tendent toutes à un même but à savoir: procurer aux cultivateurs les semences les plus productives possibles. Leur administration deviendrait facilement compliquée si chacune d'elles ne se rattachaient pas à un système unique. Ce système ou plutôt l'organisation provinciale qu'il y a dans Québec pour promouvoir la production des bonnes semences peut se décrire comme suit:—

1.—La Société Coopérative Agricole des Producteurs de Grains de Semences de Québec, ayant son siège social à Sainte-Rosalie Jonction, peut être considérée comme le centre de cette organisation provinciale. Cette société qui est née d'initiative de cultivateurs et qui ne date que de 1914, compte actuellement, dans la Province, 800 membres. Elle reçoit de l'assistance du Gouvernement Provincial de Québec et travaille en étroite coopération avec ses officiers. Ses entrepôts de Sainte-Rosalie sont munis des machines les plus perfectionnées pour faire le nettoyage et la classification des grains. Les cribles américains les mieux réputés y sont réunis et font le premier travail de nettoyage des semences, ce travail est ensuite continué par des trieurs alvéoles français et belges de grande capacité. Ces dernières machines font subir aux semences une préparation toute spéciale en ce qui concerne la pureté et l'uniformité.

Les opérations de cette coopérative ne tendent nullement à accumuler de gros profits pour les détenteurs d'actions, mais elles visent plutôt à faciliter aux cultivateurs l'obtention, à des prix raisonnables, de semences supérieures que le commerce ordinaire n'est généralement pas en mesure de fournir.

Cette société travaille en étroite coopération avec l'Association Canadienne des Producteurs de Semences et tend de plus en plus à limiter son commerce à la vente des grains enregistrés et contrôlés par cette dernière association.

2.—Par ailleurs, les Gouvernements provincial et fédéral coopérant,—tendent à organiser, dans les endroits les plus propices de la Province, par l'intermédiaire des sociétés d'agriculture de comtés, avec lesquelles l'agronome a des rapports constants, l'organisation des concours de semences pures. Ces concours reçoivent de la part des Gouvernements des octrois généreux. Les concurrents, pour pouvoir y prendre part, doivent se procurer au début une semence sélectionnée et acceptée par un conseil provincial.

La préférence dans le choix de semence est toujours donnés aux grains enregistrés.

Le concours subit deux inspections, une lorsque la récolte est sur pied et la seconde, au cours de l'hiver, après que les grains ont été battus et bien sélectionnés. Les concurrents qui se sont ainsi procuré ces semences d'élite pour pouvoir prendre part au concours, prennent généralement un grand soin de la récolte qu'ils en obtiennent. Ils réunissent généralement, dès la première année, toute la semence pure nécessaire pour renouveler complètement leur semence l'année suivante.

C'est le moyen que le Gouvernement emploi pour créer, dans les endroits qu'il juge propices, des centres de production de telle ou telle semence. Par ce système, les cultivateurs organisés de cette Province ont produit, l'an dernier, à peu près 20,000 minots d'avoine Bannière enregistrée. D'après les prévisions de cette année, cette production triplera en 1921. De semblables efforts sont aussi tentés en vue de multiplier, suivant

Elévateur à grain.

le même système, quelques autres variétés recommandables d'avoine et de blé.

3.—Comme troisième facteur de succès dans cette organisation, il faut encore citer le département des céréales du Collège Macdonald qui a, par une entente spéciale, consenti à joindre ses efforts à ceux des Gouvernements et de la Société Coopérative de Sainte-Rosalie. Les officiers en charge de ce département consentent à prendre la direction d'une station de multiplication de semence d'élite qui a été annexée à la Société de Sainte-Rosalie. A cet effet, la société a fait l'achat d'une ferme adjacente à ses entrepôts qui sera dorénavant utilisée pour des fins de multiplication des meilleures lignées de semences qui pourront être obtenues. Cette ferme réunie sous le rapport du climat et du sol des conditions moyennes de la Province. Les semences qui auront été ainsi multipliées sur cette ferme seront sélectionnées dans les entrepôts de la société et distribuées, par l'intermédiaire de la société et sous la direction du conseil provincial, à différents centres de production.

Semblable organisation permet donc à la Société Coopérative de Sainte-Rosalie de fournir aux centres de production la semence de début et d'acheter ensuite le produit de la récolte pour alimenter son commerce régulier à travers la Province et à l'étranger.

Elle permet encore de contrôler la distribution des variétés de semences les plus recommandables et de rehausser considérablement la qualité des grains de commerce.

Si la Province de Québec ne peut soutenir la compétition des Provinces de l'Ouest pour les grains de commerce, elle offre des conditions particulièrement avantageuses pour la production de certaines semences spéciales, telles que celles du blé, de l'avoine, des pommes de terre, etc. . .

Qu'il nous suffise, pour appuyer cette assertion, de citer quelques phrases du secrétaire de l'Association Canadienne des Producteurs de Semences, M. L.-H. Newman :—

"D'une manière générale, la province de Québec jouit " de plusieurs avantages uniques comme province pro- " ductrice de céréales et de pommes de terre de qua- " lité supérieure.

"Il n'a généralement qu'un petit nombre de cultures " différentes sur la même ferme, ce qui éloigne le dan- " ger des mélanges. Bien des cultivateurs, sinon la ma- " jorité, possèdent leur propre batteuse et ont tout le " temps nécessaire pour la nettoyer convenablement. "La folle-avoine qui constitute un véritable fléau pour " les provinces de l'Ouest et plusieurs parties de l'On- " tario, ne se rencontre pas très souvent ici. Géogra- " phiquement, vous êtes bien situés et pour le commerce " local et pour l'exportation.

"Les conditions qui favorisent la production d'une " semence de pommes de terre de la meilleure qualité " se trouvent toutes réunies ici. Aussi semble-t-il que " la province de Québec deviendra rapidement le cen- " tre producteur de patates pour toute l'Amérique du " Nord.

"Vous êtes très avancés dans les méthodes de com- " merce coopératif et vous marchez dans ce sens avec " une étonnante rapidité. Vous avez déjà votre Société " Coopérative des Producteurs de Semences avec ses " quartiers généraux à Sainte-Rosalie, où il y a un " splendide entrepôt pour la sélection des grains. Dans " l'installation et l'opération de cet entrepôt, vous " n'êtes encore surpassé par aucune organisation de ce " genre dans le pays, et vous vous êtes acquis une ré- " putation enviable."

La Solution du Problème de l'Azote

Produits azotés synthétiques.

Par H.-M. NAGANT, I.A., I.F.,
Professeur à l'Institut Agricole d'Oka.

(Suite des numéros d'avril et mai.)

Cyanamide de calcium.—Il y a déjà longtemps que les chimistes ont songé à transporter du laboratoire à l'usine certaines méthodes de préparation synthétique des composés azotés.

Tel fut notamment le cas pour les cyanures alcalins dont l'usage pour l'extraction de l'or de ses minerais, fit augmenter de beaucoup la demande aux environs de l'année 1890.

C'est au cours de recherches faites pour effectuer la synthèse des cyanures en partant de l'azote atmosphérique que naquit une nouvelle industrie, rapidement établie sur une base solide, celle de la *cyanamide de calcium.* Lorsqu'en 1894 Moisan et Wilson introduisirent un procédé pour la fabrication économique et sur une grande échelle des carbures de calcium et de barium (CaC_2, BaC_2î dans le four électrique, les chimistes Allemands, Frank et Caro résolurent d'étudier à fond les problèmes relatifs à la synthèse des cyanures, par la réaction de l'azote sur ces carbures.

Chauffés à haute température, en présence d'azote, les carbures de calcium et de barium absorbent ce gaz, en éliminant la moitié du carbone que renferme leur molécule, suivant la réaction.

$CaC_2+N_2=CaCN_2+C$

Sous l'effet de conditions favorables, la cyanide peut reprendre le carbone, mis en liberté, pour former du cyanure de calcium :

$CaCN_2+C=Ca\ (CN)_2$

On reconnut bientôt que la cyanamide constituait le produit azoté synthétique le meilleur marché de sa catégorie; et lorsqu'en 1901 H. Freüdenreich trouva qu'il pouvait être employé avantageusement comme source d'azote pour les plantes, en agriculture, de vastes perspectives s'ouvrirent pour l'industrie basée sur les brevets Frank et Caro, qui dataient de 1895 et 1898.

Le produit lui-même, qui se présente sous forme d'une matière pulvérulente noire na pas rencontré un grand succès dans son emploi agricole, à cause de plusieurs inconvénients qui lui font préférer le nitrate du Chili ou le sulfate d'ammoniaque, mais, heureusement on a trouvé le moyen de convertir facilement l'azote amidé en azote ammoniacal et de là en sulfate d'am-

moniaque, engrais, très apprécié. On obtient par exemple ce résultat en soumettant la cyanamide de calcium à l'action de la vapeur d'eau surchauffée dans une autoclave, il se produit une hydratation avec formation d'ammoniaque et d'hydroxyde de chaux.

Aussi il y a déjà des usines qui ne font pas autre chose que de convertir la cyanamide en azote ammoniacal. Nous ne dirons pas plus sur la fabrication de la cyanamide de calcium, qui a déjà subi bien des perfectionnements et des modifications depuis ses débuts. Ceux que la question intéresse pourront trouver de plus amples renseignements dans des brochures déjà publiées avant la guerre, telles que: "*Industrie et Commerce des Engrais", par Ch. Pluvinage*, (Paris, Baillières) ; *Utilization of Atmospheric nitrogen" par Thomas Norton*, (Washington). Ajoutons que les usines qui ont surgi dans tous les pays et les chiffres, déjà énormes, de production de la cyanamide prouvent assez que cette industrie est établie sur une base commerciale et économique. Les statistiques suivantes, publiées, en Janvier 1918, par *l'Institut International d'Agriculture de Rome*, démontrent d'une façon éloquente l'impulsion formidable communiquée à l'industrie de la cyanamide, par la guerre:

Production de la cyanamide de calcium à 20% d'azote.

Pays	Année 1914 Tonnes	Année 1916 Tonnes
Allemagne	36,000	500,000
Autriche-Hongrie	7,000	24,000
France	7,000	100,000
Italie	16,000	20,000
Suède et Norvège	33,000	220,000
Etats-Unis et Canada	64,000	64,000
Suisse	7,000	29,000
Japon	7,000	29,000
Totaux mondiaux	194,000	981,000

On le constate que les deux premières années de la guerre ont vu quintupler une production déjà respectable; la France, par exemple, a employée une proportion notable des pouvoirs hydroélectriques qu'elle a équipés depuis le début du conflit, à la fabrication de ce produit azoté.

Pour l'économie de production la cyanamide semble, jusqu'ici, l'emporter encore de beaucoup sur le 2me composé synthétique obtenu industriellement aux dépens de l'azote atmosphérique:

Acide nitrique de synthèse et nitrates.

L'oxydation de l'azote de l'air sous l'influence des températures élevées abtenues à l'aide du courant électrique ou d'explosions internes a été reconnu et étudiée par nombre de savants au cours du siècle dernier.

La première mention d'un essai d'industrialisation du principe remonte à 1859 lorsqu'une dame Lefebvre, de Paris, obtint un brevet en Angleterre pour la fabrication de l'acide nitrique à l'aide de décharges électriques. Depuis un assez grand nombre d'autres tentatives infructueuses ont été signalées, jusqu'à ce que le professeur Birkeland, de l'Université de Christiana, aidé d'un norvégien, du nom de Samuel Eyde, établisse les détails d'une méthode nouvelle et très simple, basée sur l'oxydation de l'azote dans de l'air soumis à des températures extrêmement élevées, dépassant les 3,000°, centigrade, produites par l'arc électrique dans un four spécial.

Nous ne pouvons nous étendre davantage sur les principes réagissant la préparation de l'azote nitreux et nitrique par les procédés Birkeland et Eyde ou les variantes qui apparurent presque simultanément sous les noms de méthodes Schönherr et Pauling. Pour plus amples informations nous renvoyons le lecteur aux mêmes sources que celles indiquées à propos de l'azote amidé.

Mais afin de faire concevoir la dépense énorme d'énergie électrique que requiert actuellement la fabrication de l'acide nitrique par l'un de ces procédés, établissons les quelques points suivants:

Les réactions donnant lieu à la formation d'acide nitreux et d'acide nitrique peuvent se résumer comme suit:

1° Sous l'action de la chaleur développée par l'arc électrique, il y a combinaison de l'azote de l'air avec l'oxygène et formation de bioxyde d'azote:

$N_2 + O_2 = N_2O_2$.

2° Lorsque la température s'abaisse endessous de 600° centrigrade, le bioxide dazote se combine avec

H. M. NAGANT

une nouvelle quantité d'oxygène pour former du peroxyde:

$N_2O_2 + O_2 = N_2O_4$,

lequel en présence de l'eau douce donne naissance à de l'acide nitreux et de l'acide nitrique:

$N_2O_4 + H_2O = HNO_2 + HNO_3$.

La réaction $N_2 + O_2 = N_2O_4$ est fortement endothermique, absorbant, par molécule gramme formé, 43,150 calories; or, jusqu'ici, on n'est pas encore parvenu à obtenir un effet, utile à la réaction, de plus de 3 ou 4% de la chaleur totale engendrée par l'arc électrique.

Aussi tandis que le kilowatt heure peut fournir 70 grammes d'azote combiné à l'état de cyanamide, en

partant de l'azote, de la chaux et du carbone, il ne peut dans les conditions techniques actuellement les plus favorables donner que 17 grammes d'azote sous forme d'acide nitrique. (*Utilization of Atmospheric Nitrogen, by Thomas H. Norton.*)

Comme on le voit il reste une margè très large, pour une plus grande économie dans la production de l'acide nitrique synthétique, par une utilisation plus des calories développées par le courant électrique.

D'autre part la fabrication de l'azote amidé pourrait être très utilement combinée avec celle de l'azote nitrique de synthèse. Par la conversion du premier en ammoniaque on a un excellent neutralisant de l'acide nitrique, permettant d'obtenir du nitrate d'ammoniaque, engrais azoté de tout premier ordre, le plus concentré que l'on puisse imaginer. Jusqu'ici on avait surtout employé la chaux comme neutralisant; ce qui fournissait le nitrate de chaux de Norvège, qui, à part l'inconvénient d'être hygroscopique, occasionne des frais de transport pour un produit sans valeur commerciale tel que la chaux, lorsque les expéditions se font au loin.

La fabrication de l'azote nitrique semble s'être confinée surtout dans les installations de la société hydroélectrique Franco-Norvégienne qui s'est assurée d'immenses pouvoirs d'eau s'élevant à plusieurs centaines de mille chevaux en combinaison, avant la guerre du moins, avec les grandes compagnies de produits chimiques, allemandes, "Badische Anilin und Soda Fabrik", la firme "Friedrich Bayer" et la "Aktien Gesellschaft fûr Anilin fabrikation" de Berlin. Les pouvoirs hydroélectriques acquis par ce puissant trust sont tous situés en Norvège; les principaux sont notamment ceux de Wamma, Tya, Matre et Ryukan.

Pour ces dernières années les statistiques concernant la production du nitrate de chaux ne sont guère apparentes; mais, déjà avant le début du grand conflit mondial, le programme des sociétés opérant en Norvège prévoyait une capacité productive de 160,000 tonnes, après équipement des différentes stations de pouvoir dont elle dispose.

Il faut remarquer aussi, qu'outre l'acide nitrique, la Société Norvégienne prépare encore du nitrite de sodium, dont l'industrie des matières colorantes, en Allemagne, consommait plusieurs milliers de tonnes pour la production des composés azoïques.

On obtient le nitrite de sodium en envoyant le courant de gaz NO, du four électrique dans de la soude caustique ce qui détermine la réaction:

$$2NO + O + 2NaOH = 2NaNO_2 + H_2O$$

Malgré les résultats acquis du côté de la synthèse directe de l'acide nitrique et de la cyanamide surtout, l'intérêt et l'avenir économique semblent se diriger davantage vers la 3me conquête faite aux dépens de l'atmosphère.

L'Ammoniaque Synthétique.

La production directe d'ammoniaque, par l'union de l'azote et de l'hydrogène, ne constitue pas non plus une nouveauté en laboratoire, puisque dès 1846 Reynault démontra qu'il y avait formation de traces d'ammoniaque lorsqu'on faisait passer une étincelle électrique à travers un mélange d'hydrogène et d'azote; mais la proportion produite restait extrêmement faible, le gaz ammoniac ayant une tendance à se dissocier aussitôt qu'elle augmentait.

Ce n'est que dans ces dernières années qu'on a pu songer à faire passer du domaine purement scientifique dans celui de la réalisation pratique la synthèse de l'ammoniaque, grâce surtout au bon marché de l'azote pur extrait de l'air liquéfié ou développement donné à la production de l'hydrogène, demandé en grandes masses par l'aérostation.

En 1910, le professeur Haber, de Karlsruhe, publia les détails de la fameuse méthode, pour la production synthétique de l'ammoniaque, à la mise au point de laquelle il travaillait depuis quelques années.

Principe du Procédé Haber.

Le principe en est extrêmement simple. Lorsqu'on comprime un mélange d'azote et d'hydrogène, dans la proportion d'un volume du 1er gaz contre trois du second, dans un cylindre en acier, sous une pression très élevée, de 175 à 250 atmosphères, mais à une température relativement basse, 500° C. environ, en présence d'un agent catalytique, tel que l'uranium, l'osmium, le fer, etc., il y a formation de gaz ammoniac.

La réaction est rapide au début mais ralentit bientôt, de sorte que, pour une température voisine de 500° C., elle s'arrête pratiquement quand la proportion d'ammoniaque, dans la chambre de réaction atteint 8% du contenu. On peut alors extraire l'ammoniaque, ou bien en faisant passer les gaz de celui-ci à travers de l'acide sulfurique, qui absorbe le NH_3 pour former du sulfate d'ammoniaque.

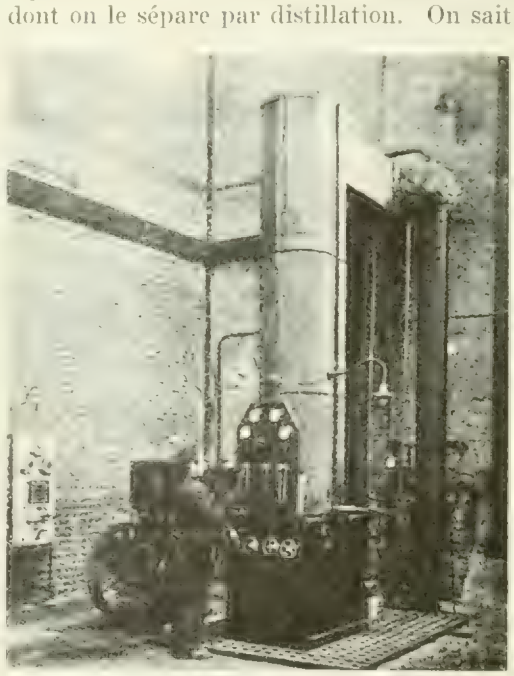
Dans les deux cas, le mélange d'azote et d'hydrogène, qui reste, est refoulé dans la chambre de réaction pour recommencer l'opération.

Le *schéma* d'un générateur d'ammoniaque, dans la méthode Haber est donc des plus simples:

Un cylindre à réaction, en acier, à parois très résistantes, contenant l'agent catalytique, lequel sert indéfiniment, une pompe à compression, une chambre de réfrigération.

Economie du Procédé Haber.

Les matières premières, hydrogène et azote, nécessaire pour la production d'ammoniaque peuvent être obtenus à des prix de revient très bas, ainsi que nous venons de le dire. Si azote, employé d'ailleurs aussi en grandes quantités dans l'industrie de la cyanamide, peut être obtenu en faisant passer de l'air sur de la tournure de cuivre chauffée, qui absorbe l'oxygène; mais il est surtout un produit de l'industrie assez récente de l'air liquide, dont on le sépare par distillation. On sait que le



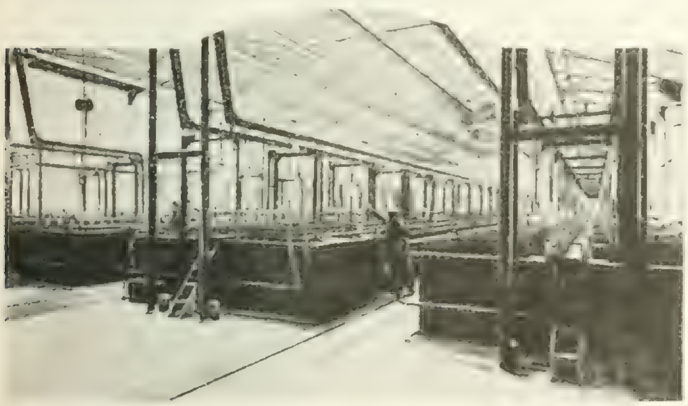
Appareil Claude pour la production de l'azote au moyen de l'air liquide.

point d'ébullition absolue de l'azote est un peu moins élevé que celui de l'oxygène; c'est sur cette propriété physique que sont basés les appareils Linde, Claude, Pictet, qui peuvent fourir de grandes quantités d'azote, assez pur, en faisant bouillir l'air liquide.

Thomas Norton, dans Utilization of Air Nitrogen, indique comme suit le prix de revient de l'azote dans quelques pays avant la guerre: En France de 2 à 10 centimes le kilogramme, (0.18 x 0.9 cent la livre); en Allemagne 3 pfennigs le kilogramme (0.32 cent la livre) serait un prix assez élevé.

L'hydrogène aussi est devenu un article de commerce relativement bon marché et des méthodes nouvelles pour l'obtenir se perfectionnent tous les jours. D'abord il constitue un sous-produit de certaines industries, telles que la préparation électrolytique du chlore et des alcalis, en partant des chlorures alcalins. Les usines de Griesheim et de Bitterfeld,. en Allemagne, dont c'est le but principal produisaient comme déchet de fabrication 10,000,000, de mètres cubes d'hydrogène, vendu au prix de 10 pfennig le mètre cube (12 cents la livre). Or l'hydrogène n'intervient que pour 17.6% dans le poids de l'ammoniaque produit, ce qui établirait le prix de revient de la quantité requise pour former une livre d'ammoniaque, à 2.11 cents. Sachant, qu'avant la guerre la valeur de l'azote ammoniacal était estimée entre 15 et 20 cents la livre on voit donc quel grand écart il reste pour couvrir les frais de fabrication et laisser un bénéfice.

Comme autres sources industrielles d'hydrogène, il y aurait à mentionner, l'électrolyse de l'eau; la décomposition de la vapeur d'eau par le fer chauffé au rouge, le carbone incandescent, et bien d'autres.



Salle d'electrolyse pour la fabrication de l'hydrogene, de la soude et du chlore.
(Cliche tire de "Chimie et Industrie".)

Enfin le facteur qui donne surtout un avantage marqué, au point de vue économique, sur ses rivaux, cyanamide et acide nitrique obtenu par le procédé de l'arc électrique, à l'ammoniaque synthétique, c'est la très faible dépense d'énergie qu'entraîne sa fabrication.

En tenant compte que la réaction, $N_2 + 3H_2 = 2NH_3$ est exothermique; qu'une bonne partie de la chaleur dépensée à porter le mélange gazeux, du cylindre de réaction, à la température voulue peut-être récupérée, après la réaction, au profit des nouvelles charges d'azote et d'hydrogène, introduites dans l'appareil, on peut estimer la dépense d'énergie, sous forme de combustible ou de pouvoir électrique d'une autre source, comme insignifiante, dans une installation considérable. Elle n'atteindrait même pas le coût de la matière première, que nous venons d'établir. (*Utilization of Atmospheric Nitrogen*, by Thomas Norton).

Cette circonstance permet donc l'établissement de l'industrie de l'ammoniaque synthétique dans tous les pays, tandis que celle des deux premiers produits de synthèse ne peut--être économique que pour autant qu'on dispose de pouvoirs hydrauliques, non utilisables pour des industries plus rémunératrices.

Difficultés à Vaincre Dans le Procédé Haber.

Mais, à côté des grands avantages d'économie, d'énergie et de la simplicité du principe, le procédé Haber comporte des difficultés, d'ordre mécanique dans la construction et la mise au point de l'appareil, résultant de la pression énorme à laquelle se fait l'opération. Si les ingénieurs de la "Badische Soda und Anilin Fabrik" les ont surmontées il semble bien que ce soit là leur secret, qui a permis à l'Allemagne d'établir d'emblée, sur une vaste échelle la production de l'ammoniaque synthétique.

Voici ce qu'en dit Georges Claude dans un article paru dans la revue "*Chimie et Industrie*", numéro de juillet 1920, trois ans après l'apparition des notes précédentes, dans lequel il expose son innovation des *hyperpressions* appliquées au procédé Haber, à propos des usines gigantesques érigées par la "Badische" à Oppau, durant la guerre:

"Dès que la défaite de la Marne ruine, en effet, les espérances de nos ennemis en une victoire foudroyante, dès qu'il apparait que la guerre va être longue, des dispositions sont prises pour agrandir démesurément l'usine d'Oppau, pour faire des appareils déjà énormes du début, des appareils formidables, pour déployer en un mot, avec l'aide puissante de l'Etat, un effort dont on aura l'idée quand on saura que plus de 200 millions de marks, des marks d'avant-guerre, ont été dépensés dans cette unique installation. Et si cette formidable usine, véritable cité de Titan que le visiteur ne peut parcourir sans un sentiment d'affarement, constitue un tout éminemment complexe et délicat dont, au dire de ses dirigeants, on n'aurait pu garantir le fonctionnement si quelques-uns des ingénieurs qui l'ont conçue et mise au point étaient venus à disparaître, il n'en est pas moins vrai que ce gigantesque effort a porté ses fruits. Construite pour une capacité de 250 tonnes d'ammoniaque par jour, l'usine en livre 75,000 tonnes en 1917 et, paraît-il, 100,000 en 1918, correspondant à plus de 500,000 tonnes de sulfate.

On peut donc dire que l'oeuvre de la "*Badische*" a coûté à la France plus que la plus sanglante des batailles. C'est grâce à elle que la guerre a pu être prolongée deux mortelles années... *on mesure une fois de plus ce que peut rendre la science quand on a foi en elle et combien lourde fut la faute de ceux qui ont brisé chez nous, dans tant de directions, l'effort de nos savants et de nos [illegible]*"

(A Suivre)

LES GRANDS HOMMES.

C'est par eux que le genre humain marche de plus en plus à la science et au bonheur. Les sages et les habiles des divers siècles ajoutent sans cesse à ce trésor commun où puise l'humanité, qui sans eux serait restée dans sa pauvreté primitive, c'est-à-dire dans son ignorance et la faiblesse. Poussons donc à la vraie science: car il n'y a pas de vérité qui, en détruisant une misère, ne tue un vice. Honorons les hommes supérieurs, et proposons-les en imitation, car c'est en préparer de semblables, et jamais le monde n'en a eu un besoin plus grand.—Mignet.

La Classe Agricole et les Caisses de Crédit Rural

Par A. PAIEMENT, de Saint-Hermas

L'intérêt que j'ai porté, depuis quelques années, à la formation de coopératives d'assurances et d'épargnes, dans ma paroisse, et les résultats que nous avons obtenus, m'ont poussé à ne pas refuser la bonne volonté dont m'a demandé de faire preuve en venant dire quelques mots de l'expérience que nous avons faite, à Saint-Hermas, comté des Deux-Montagnes, des caisses de crédit rural.

L'on se rend de plus en plus compte que, sans être une panacée à tous les maux, les sociétés coopératives réussissent, dans une certaine mesure, à réduire le coût de la vie et à tenir, jusqu'à un certain point, les trusts en respect. Mais ces sociétés n'atteidront leur plein développement, ne donneront leur pleine mesure de leur force et de leur puissance que lorsque le crédit agricole sera bien organisé, facile à obtenir. Si nous pouvons aussi créer dans le peuple un grand mouvement d'économie et d'épargne, nous assurerons à notre province, par la mise en oeuvre de cette épargne d'une façon intelligente, la plus haute prospérité. Les Caisses paroissiales, système Desjardins, ou Caisses Populaires, ont été reconnues partout comme l'un des plus puissants leviers économiques qui nous aient été mis entre les mains. Elles habituent le peuple à épargner, à faire ses achats au comptant, et lui procurent, à des conditions très avantageuses, le capital dont il a besoin pour conduire à bonne fin ses entreprises. Elles ne font pas toujours l'affaire cependant des spéculateurs égoïstes et beaucoup de préjugés ont été soulevés contre elles. Les coups qu'on leur a portés retournent heureusement contre leurs auteurs et prouvent, avec plus d'évidence, que ces organisations d'épargne et de crédit, vraiment canadiennes, sont d'une grande vigueur et une sauvegarde contre la finance égoïste qui pressure le peuple. Les institutions financières qui combattent les Caisses Populaires les connaissent mal ou pas du tout. Elles ont tort d'oublier que le cultivateur et l'artisan ont le droit de se protéger et de travailler à leur avancement.

La Caisse Populaire est formée dans un esprit chrétien. Elle ne demande qu'à rendre service. Elle ne spécule pas, ne vise pas aux gros profits. Elle s'applique à faire fructifier dans la paroisse même les argents qu'on lui confie. Elle permet aux paroissiens de s'aider les uns les autres. N'arrive-t-il pas souvent, à la campagne, que de braves citoyens, en quête de capitaux, ne savent pas où s'en procurer, alors que d'autres, qui en auraient à prêter, ne savent pas à qui s'adresser? La Caisse permet aux uns et aux autres de se rencontrer. C'est un intermédiaire des plus utiles et des moins exigeants, faisant tout pour presque rien et travaillant pour tout le monde avec la même humeur.

Qui n'a rencontré, dans nos campagnes, de ces prêteurs qui, sans être malhonnêtes, ne se font pas scrupule d'exercer une espèce d'esclavage envers ceux qui leur sont obligés? Souvent, sur une question d'intérêt public ou privé, un seul regard suffi pour laisser voir à l'emprunteur ce qu'on exige de lui. La Caisse Populaire, elle, ne flatte aucune coterie, ni ne maltraite personne. Elle laisse à tous la liberté, pratiquant la charité et travaillant sur les principes de la coopération.

Combien de fois n'ai-je pas rencontré au bureau de la Caisse Populaire de ma paroisse des sociétaires en quête de renseignements sur un acte mal rédigé, sur un billet mal fait, etc. Ces constatations, ajoutées au fait suivant, nous ont poussé à Saint-Hermas, à fonder une Caisse Populaire.

Un jour, un cultivateur, propriétaire de deux terres presque payées entièrement, voulant augmenter son troupeau, me demanda si je pouvais lui prêter $60.00 pour acheter une vache qui lui était offert à très bon marché. Je n'avais pas le montant. Je lui propose de s'adresser à tel autre paroissien. Il n'en a pas, me dit-il. Tu es le sixième à qui je demande cet argent. Personne n'en a. Je le regrette, car cette vache est bon marché. Celui qui la vend sacrifie $20 pour toucher immédiatement l'argent d'un versement qu'il doit faire demain. Comme il est moins gênant de chercher de l'argent pour un autre que pour soi-même, je rencontre quelqu'un qui lui prête $140. Cette somme lui permet d'acheter deux vaches. Il en revendit une à l'automne plus cher qu'il ne l'avait payée.

C'est alors que j'ai commencé à m'intéresser aux Caisses populaires. J'avais lu quelques articles, dans le *Devoir* à ce sujet, mais il ne m'en était resté qu'une idée assez vague, et, comme bien d'autres, je n'osais pas attacher le grelot. Ce n'est que quelques mois plus tard que je fus inviter à assister à l'assemblée annuelle de la Caisse de l'Immaculée-Conception. Après l'assemblée, le R. P. Jésuite, qui l'avait présidée, m'invita au bureau de cette Caisse, et c'est là que je fus émerveillé de ce que pouvait faire une Caisse populaire. J'en parlai à notre Curé et nous décidâmes de demander à M. Desjardins de venir implanter son oeuvre dans notre paroisse. L'absence de M. Desjardins, la maladie de notre Curé, retardèrent la fondation de la Caisse jusqu'au 12 août 1915, alors que nous traversions des circonstances extrêmement difficiles. Nous venions d'avoir une lutte des plus contestées sur la prohibition et les esprits étaient surexcités. De plus, une sous-agence de banque s'établissait dans notre village. Nous calculions cependant que les obstacles augmenteraient si nous retardions davantage. Le Commandeur Desjardins vint à la date convenue. L'assemblée ne fut pas un succès: exactement 27 personnes dont 13 chefs de familles seulement. Cependant, en dépit des prophètes de malheur qui assuraient qu'elle ne vivrait pas longtemps, la Caisse fut établie. L'enthousiasme n'était pas bien chaud. La plupart même de ceux qui assistaient à l'assemblée le regrettaient, tant ils craignaient de faire rire d'eux. Une fois que la Caisse fut fondée, le plus difficile fut de convaincre nos sociétaires d'y déposer leur épargne. Pour les encourager un peu, nous leur disions que la Caisse Populaire de Saint-Roch de Québec n'avait eu que trois personnes à sa première assemblée, neuf à sa deuxième, et, qu'à sa troisième seulement, ils furent assez nombreux pour constituer un quorum; que cette caisse compte actuellement 1,000 sociétaires. Les prophètes de malheur continuèrent à dire que ça ne marcherait pas, que ceux qui déposeraient perdraient leur argent. Un conférencier, même, qui était venu parler en faveur d'une autre institution financière, déclara, en présence des paroissiens, que les caisses populaires sont des nids à chicane, qu'elles ne servent qu'à ceux qui, endettés jusqu'au cou, ne pouvant trouver à emprunter de l'argent ailleurs, fondent d'autres organisations pour tâcher d'en avoir, etc. Le malaise dura assez longtemps. La vérité, à la fin, triompha. Quand on songe qu'il est passé près de $600,000 au bureau de cette caisse, depuis sa fondation, dans une paroisse de 900 âmes, on doit conclure que la confiance est avec elle.

Afin de mieux faire connaître les services que notre caisse nous a rendus, nous examinerons quelques-uns des prêts qu'elle a consentis à ses membres et qui ont contribué beaucoup à la faire apprécier.

Un cultivateur, voulant acheter un cheval qui lui était offert à un prix très avantageux, n'ayant que $50 en mains alors qu'on lui en demandait $200.00, emprunta, à la Caisse, $150.00 pour un mois. Un mois plus tard, il vendit un autre cheval dont il n'avait plus besoin, remit son argent et paya l'intérêt: neuf sous.

Toute personne peut remettre des accomptes quand il le désire et l'intérêt n'est exigé que pour le temps durant lequel la somme a été gardée. Une autre personne emprunta $200.00 pour deux mois. Le lendemain, elle retira des argents qu'elle n'attendait pas si tôt, remit son emprunt et paya l'intérêt de deux jours. Un autre avait besoin de $800.00 pour acquitter sa terre. Nous étions un peu dans l'embarras, car, dans les premiers temps, nos fonds étaient fort limités. Suivant nos règlements, nous ne prêtions que $300.00 au même sociétaire. Ce règlement est amendé depuis longtemps. Cependant le gérant lui proposa de lui prêter $300.00 et de lui faire prêter la balance par un autre sociétaire qui avait l'argent en mains, ce qui fut accepté de part et d'autre avec beaucoup de satisfaction. L'idée alors nous est venue de trouver des placements pour les prêteurs, ce qui nous fournit l'avantage de répondre à de plus fortes demandes d'argent sans trop immobiliser nos fonds. La Caisse prête une partie du montant en permettant à l'emprunteur de remettre des accomptes à volonté et le prêteur, qui n'aime pas à recevoir son argent par petits montants, prête la balance pour un temps fixe, deux, trois, ou cinq ans et quelque fois dix.

Un autre devait donner $2,000.00 pour acquitter sa terre. Un prêteur devait lui procurer cette somme tel jour, lui-même devait la remettre à un autre lequel devait la donner à un troisième, venu spécialement du Montana pour régler cette question. Comme le premier fit défaut le matin même, tous les autres éprouvèrent le même désappointement. Trouvant cependant $1,000.00 à emprunter, il vint à la Caisse populaire pour obtenir la balance. Quoi qu'il demeurait dans une autre paroisse depuis quelque temps, le prêt lui fut consenti et tout se régla assez tôt pour que notre Américain pût reprendre son train. Un autre encore désirait acheter une terre au montant de $6,000.00. Comme il ne pouvait faire aucun paiement comptant, il offrit de s'assumer une hypothèque de $3,000.00 et de payer la balance, $200.00 par année. Nous lui permîmes de faire sa transaction au comptant en lui avançant les 3,000 dollars sur des garanties collatérales qu'il avait en mains. Une preuve que cette transaction était avantageuse, c'est qu'il a depuis acquitter sa terre et que la Caisse vient de lui faire placer un prêt de $2,500. Un autre avait besoin de $7,500 pour acheter une terre. Il lui fallait cet argent pour le lendemain matin. La Caisse souscrivit $2,500 et deux sociétaires la balance. Un autre, qui trouvait à s'établir ailleurs, nous demanda d'accepter le transport de $8,000.00 d'hypothèque qui lui revenait sur une propriété, et, comme ce sociétaire s'attendait à avoir besoin de son argent un peu d'avance, il avait soumis cette affaire à la Caisse qui l'avait jugée bonne. Quand il décida de conclure son marché, en moins d'une demi-heure il avait son argent, la Caisse souscrivait $4,500.00 et deux sociétaires, la balance. Il est à noter que, lorsqu'il avait emprunter le même montant un an auparavant, il avait dû payer une commission de $200.00 à l'agent intermédiaire.

Outre ces prêts considérables, nous avons fait une foule de petits prêts qui ont rendu des services des plus appréciables aux citoyens et citoyennes de la région.

Lorsqu'il s'agit d'achats en commun, la Caisse populaire est toujours le coffre-fort sur lequel on peut compter. Il y a trois ans, quelques cultivateurs achetèrent un char de grain de l'Ouest par l'entremise de l'un de leurs amis. La Caisse leur avança $800.00. Ils épargnèrent environ 30 pour cent et eurent l'avantage de remettre cet argent par de petits montants à la fois. Plus tard, le Cercle agricole acheta des graines de semence d'une Société coopérative qu'il paya comptant et à bien meilleur marché, grâce à la Caisse populaire. Des cas identiques se sont présentés en différentes occasions, et chaque fois cet organisme paroissial a répondu à nos besoins.

On a fait parfois aux Caisses populaires le reproche d'être des organisations trop locales pour être de quelque intérêt général pour la province. Plusieurs faits ont démontré le contraire. La Commission scolaire d'une paroisse voisine ayant besoin d'argent fit appel à notre Caisse qui lui avança $4,000.00 durant six mois à 5½ pour cent d'intérêt. Nous prêtâmes $5,000.00 à une fabrique dans les mêmes conditions et $1,400.00 à une autre. Une Corporation municipale, située dans un centre d'affaires, et se trouvant dans un besoin urgent d'argent obtint $1,600.00 de notre Caisse à 5½ pour cent. Dans toutes ces paroisses, il y a des banques, mais aucune ne pouvait offrir des conditions aussi avantageuses.

Voici une résumé des opérations de notre Caisse fondée depuis cinq ans avec 27 sociétaires dans une petite paroisse de 900 âmes, sans importance commerciale et essentiellement agricole. Afin d'abréger je ne donne les chiffres que de la première et de la cinquième année: en 1915, nous fîmes 57 prêts au montant de $12,004.00. Les dépôts s'élevèrent à $31,655.00, le chiffre total d'affaires à $53,015.00, et les bénéfices à $411.00. L'an dernier, cinq ans après, nous faisions 149 prêts au montant de $48,593.00, les dépôts s'élevaient à $466,046.00, le montant total d'affaires à $577,230.00, et les bénéfices à $1,797.00. Depuis les débuts de la Caisse, nous avons fait 519 prêts au montant de $130,564.00. Notre Caisse n'a jamais subi un sou de perte.

Le cas de la Caisse Populaire de Saint-Hermas est celui de la plupart des caisses de la Province. On dira peut-être: comment se fait-il qu'il n'y a pas plus de ces institutions dans notre Province? La réponse est facile à donner. Personne n'est financièrement intéressé à l'établissement des nouvelles Caisses de Crédit Rural. Il faut toujours un peu de dévouement pour les établir et combattre les préjugés nés de l'égoïsme et de l'intérêt de quelques spéculateurs qui veulent vivre aux

Les Caisses Populaires sont nées d'initiatives privées. Que les gouvernements prête son concours pour les multiplier dans la Province, c'est désirable, mais il ne faudrait pas enchaîner leur liberté, les déranger de la voie qui leur a été tracée. Elles ont traversé des moments difficiles et ont fait preuve d'une vigueur extraordinaire. Partout où elles existent elles font du bien. Répandons-en l'idée, encourageons-en l'établissement dans toutes les paroisses. Nous ferons ainsi une oeuvre vraiment nationale, digne de nos paroisses, lesquelles, selon le mot du regretté fondateur de ces Caisses de crédit, offrent un champ d'action admirable pour un organisme économique dont les opérations sont surtout basées sur la confiance mutuelle.

A Travers le Comté de Portneuf

Par JEAN-CHARLES MAGNAN, Agronome de district

Le comté de Portneuf est immense: il comprend 60,-000 carrés d'étendue. Vingt-cinq paroisses formant une population de 35,000 âmes. La population est essentiellement rurale, sauf celle de deux centres manufacturiers. Il y a des montagnes (les Laurentides), de vastes plaines fertiles, des plateaux rocailleux, des rivières à profusion. On compte 14 paroisses dont le sol est presqu'entièrement sablonneux ou rocailleux; tout de même, on y cultive la terre depuis plus de 100 ans et les cultivateurs y vivent apparemment bien et y élèvent de nombreuses familles et même trouvent le moyen d'y établir leurs fils.

Il y a huit ans que nous avons l'honneur d'aider au développement de l'agriculture dans cette région. Ce qui nous a le plus frappé et ce qui prouve que notre travail a servi à quelque chose: *c'est l'esprit nouveau* qui se manifeste chez les ruraux de notre comté, particulièrement chez les jeunes. Notre travail de propagande, d'éducation et d'instruction s'est porté surtout

J C. Magnan.

vers la jeunesse des campagne que nous avons soigneusement éduquée, par l'Ecole, par la Famille, au moyen de visites, de conférences, de jardins et expositions scolaires, (la première exposition scolaire, section française, a eu lieu à St-Casimir, en septembre, 1914) par de concours scolaires, excursions dans les champs et sur les fermes, avec but déterminé. Nous n'avons pas négligé "les vieux ruraux", mais nous avons cru, qu'il valait mieux travailler sur des cerveaux frais, c'est-à-dire exempts de préjugés, que sur des *cerveaux achevés ou imprimés;* on ne peut refaire, en général, du neuf, avec du vieux. Le rural de 40 à 60 ans, peu éclairé, bâti dans une vieille atmosphère, qui n'a jamais eu d'ordre, qui a toujours cru que le monde finissait chez son voisin, qui croit tout savoir et n'ouvre jamais un livre; ce rural mal formé, quelles que soient ses autres qualités, ne sera jamais une force ou une lumière pour la société agricole: c'est un corps inerte, un fardeau, un poids lourd. Et, il y en a encore beaucoup qui ressemblent à ce type.

Je ne nie pas qu'il y ait une élite (20 p.c. environ). Et cette élite intelligente manque encore de quelque chose: la formation ou plutôt un équilibre mental et intellectuelle, qui nuit presque complètement à la claire vision,, je veux dire à la *conception de la chose agricole,* dans le domaine social, intellectuel, économique. Une statue, quelle que soit sa beauté relative, manque d'harmonie, d'unité, si, une disproportion la dépare; il en est de même des cerveaux.

Hélas, combien d'initiatives louables en agriculture, combien de mouvements généreux en faveur des ruraux, ont échoué chez les ruraux eux-mêmes, parce que l'on a voulu *travailler de la vieille pâte*: temps, forces et argents perdus, et, ce qui est plus malheureux, c'est le découragement et la désillusion qui prennent naissance chez les innovateurs les plus compétents et les plus désintéressés.

Cette éducation, chez les jeunes de Portneuf, a beaucoup transformé l'esprit de la jeunesse rurale des écoles. Les jardins et les expositions et tous les procédés d'éducation agricole employés, ont produits des cerveaux ouverts au vrai progrès et des *unités actives* pour l'amélioration de notre profession. Je rencontre des jeunes cultivateurs progressifs qui me disent avoir acquis, par l'éducation agricole reçue dans la région, un ensemble de qualités et une formation qui sont l'essence de leur succès et de leur vie heureuse: amour et respect du sol, fierté de leur besogne et intérêt à l'accomplir, esprit d'ordre, d'observation, de persévérence et de coopération, *compréhension de la vie rurale* sous son vrai jour, etc., etc. Ce sont de petites choses, il est vrai, mais combien nécessaires chez l'"habitant" qui veut *vivre*! (ce mot, interprété dans tous les sens).

Depuis 1914, on compte 38 expositions scolaires auxquelles ont pris part 42,352 élèves des écoles du comté de Portneuf. Le personnel enseignant, les curés, les autorités civiles, etc., ont compris notre oeuvre, (le département de l'Agriculture a donné l'excellent appui ministériel) et l'émulation des enfants et les résultats obtenus ont été notre meilleur fortifiant pour la continuation de la tâche.

Nous groupons, actuellement, *par unité,* les membres de notre nouvelle association: *Les Jeunes Agriculteurs de Portneuf* qui se recrutent chez les meilleurs élèves-jardiniers du comté (appartenant aux écoles, il y a quelques années) établis sur des terres ou vivant de l'agriculture. Le but de cette association peut se résumer ainsi: donner ce que nous avons de mieux pour l'amélioration de notre profession: l'Agriculture.

Ce n'est pas tout de nous ébranler aujourd'hui pour la colonisation, demain pour l'enseignement public, après-demain ou hier pour les caisses populaires, les problèmes ouvriers, l'organisation économique, promenant notre effort tantôt d'un côté, tantôt de l'autre, partageant tous les enthousiasmes, toutes les fièvres d'occasion. Ce qu'il faut et ce qui presse, c'est de rendre persévérant et un, un effort éparpillé et intermittent; c'est de bien établir, dans notre oeuvre de construction prochaine, le rapport des pièces au tout. C'est de proportionner et d'équilibrer toutes choses, de maintenir la hiérarchie des facteurs, pour que s'élève enfin l'édifice de la patrie dans une force solide et dans un ordre de beauté.—Abbé Lionel Groulx.

Agricultural Production in the Province of Quebec
Production Agricole dans La Province de Québec

COMPARISON BETWEEN 1911 AND 1920—COMPARAISON ENTRE 1911 ET 1920

Field Crops—Récoltes des Champs

	1911			1920		
	Superficie ensemencée Area seeded acres	Production Yield boisseaux bushels	Valeur Value	Superficie ensemencée Area seeded acres	Production Yield boisseaux bushels	Valeur Value
Blé Wheat	68,999	1,223,000	$ 1,443,000	222,045	4,163,000	$ 8,456,000
Avoine Oats	1,430,209	37,500,000	19,875,000	2,205,908	66,729,000	58,722,000
Seigle Rye	12,735	200,000	202,000	28,462	534,000	1,004,000
Orge Barley	99,762	2,271,000	1,771,000	194,444	4,910,000	6,923,000
Pois Peas	32,507	517,000	708,000	60,870	1,035,000	3,478,000
Fèves Beans	6,065	114,000	225,000	35,835	645,000	2,632,000
Sarrasin Buckwheat	112,880	2,548,000	1,886,000	151,765	3,908,000	5,393,000
Grains mélangés Mixed grains	114,347	2,925,000	2,018,000	143,423	4,195,000	5,286,000
Lin Flax	1,146	13,000	22,000	16,035	184,000	657,000
Maïs à grains Corn for husking	23,473	712,000	719,000	47,741	1,420,000	2,258,000
Pommes de terre Potatoes	124,381	15,763,000	10,561,000	310,692	57,633,000	57,633,000
Plantes-racines Roots	13,543	3,943,000	1,459,000	83,613	27,530,000	13,765,000
		Tonnes Tons			Tonnes Tons	
Foin et trèfle Hay and Clover	3,294.230	6,260,000	63,664,000	4,290,121	5,363,000	155,527,000
Maïs fourrager Fodder Corn	37,155	325,000	1,560,000	86,833	695,000	7,089,000
Luzerne Alfalfa	3,634	14,000	135,000	28,200	68,000	1,428,000
		lbs			lbs	
Tabac Tobacco	12,094	10,095,901		33,000	26,400,000	6,600,000

Total area seeded in 1911 .... 5,480,673 acres .... Superficie totale ensemencée en 1911
— — — in 1920 .... 7,905,987 acres — — — en 1920
Total value of field crops ...... $ 65,353,528 .... 1911 ...... Valeur totale de la récolte
— — — — — 330,251,000 .... 1920 ...... — — — —

Province of Quebec—Province de Québec

Dairy Industry—Industrie Laitière

	1911	1920
Butter Beurre	41,7[illegible]2,678 lbs valued at $9,961,732	37,681,366 lbs valued at $20,857,523
Cheese Fromage	58,1[illegible]09[illegible] lbs valued at $5,695,254	58,044,719 lbs valued at $15,305,488

The Department of Agriculture of Quebec maintains forty-three District Representative offices.